Modified Completion Report Monitoring

MONITORING STUDY GROUP
CALIFORNIA STATE BOARD OF FORESTRY AND FIRE PROTECTION

Modified Completion Report MONITORING PROGRAM

Implementation and Effectiveness of Forest Practice Rules related to Water Quality Protection

MONITORING RESULTS FROM 2001 THROUGH 2004

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Department of Forestry and Fire Protection

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The Resources Agency

Arnold Schwarzenegger
Governor
State of California

July 2006
SACRAMENTO, CALIFORNIA

This report:

- Describes MCR monitoring conducted from 2001 through 2004,
- Summarizes and analyzes the MCR monitoring results, and
- Makes findings and recommendations based on those results.

Modified Completion Report Monitoring

http://
www.bof.fire.ca.gov/board/msg_supportedreports

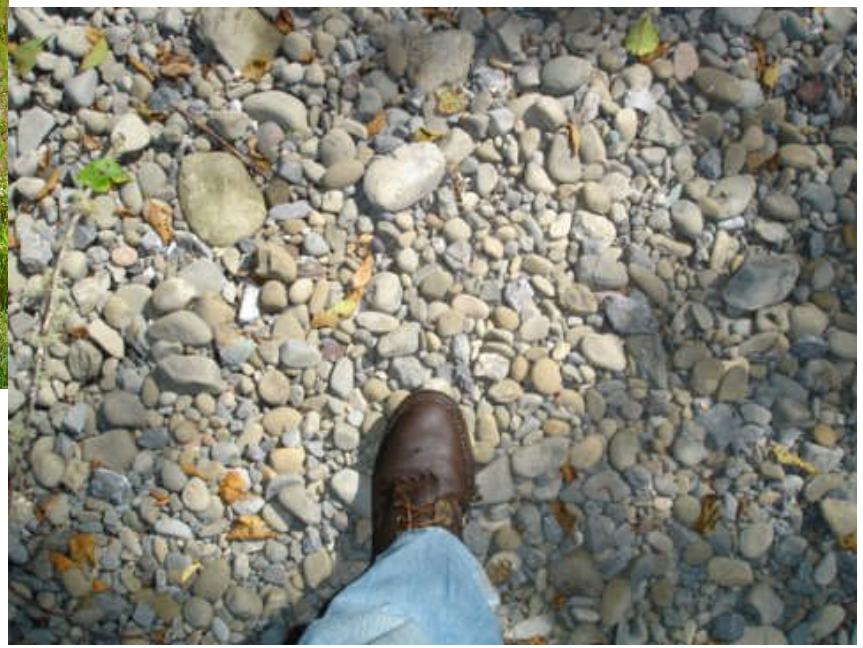
1. The Final Report,
2. MCR Methods and Procedures, and
3. This Presentation

Available on-line at the
Monitoring Study Group's (MSG's)
webpage.

- The Board of Forestry and Fire Protection and the California Department of Forestry and Fire Protection have established a long-term monitoring program, which includes a number of monitoring projects that are briefly described in the Executive Summary.

- The Modified Completion Report (MCR) project is a component of this long-term program.

Premise: The quality of the practices on the hillslope eventually affects the quality of the water and the aquatic habitat downstream.



MCR ABSTRACT

The California Forest Practice Rules (FPRs) (Title 14, California Code of Regulations) are designed in large part to protect water quality and aquatic habitat in forested watersheds during and after silviculture activities.

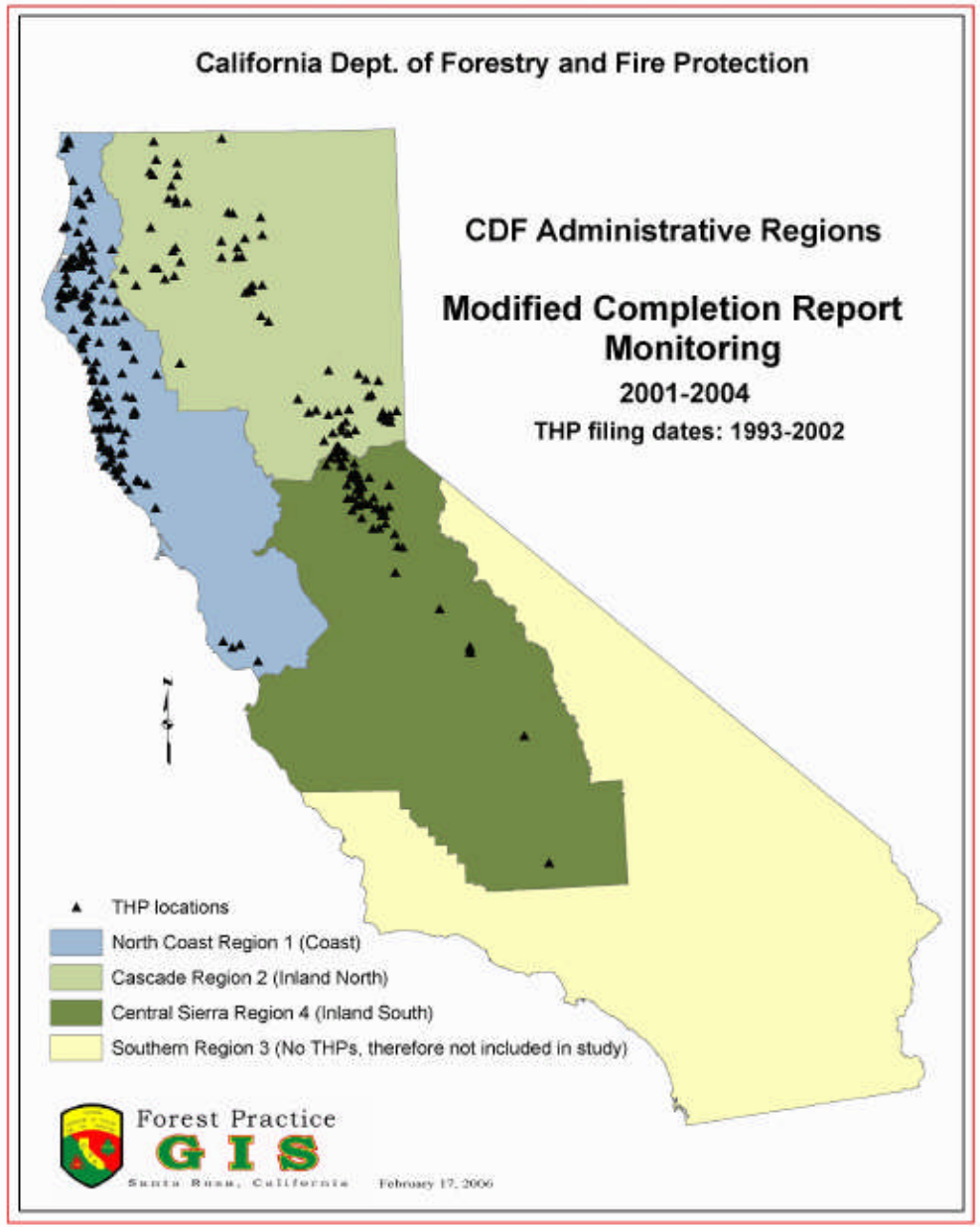
MCR ABSTRACT

The critical questions then become:

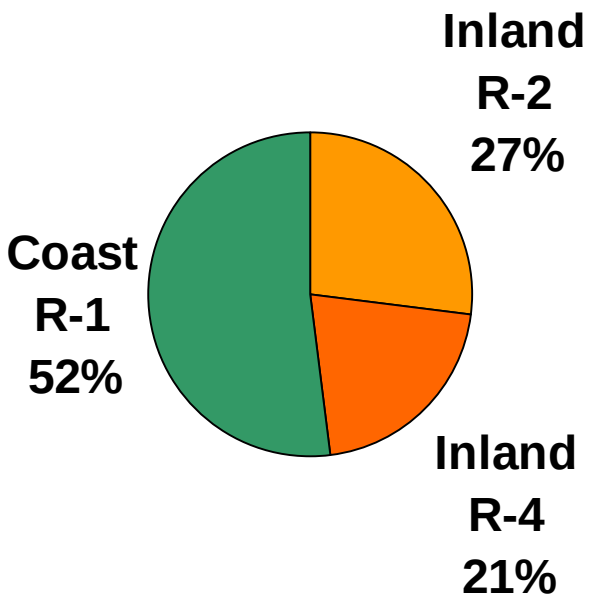
1. At what rates are the water quality related FPRs being properly implemented?, and
2. When properly implemented, how effective are these FPRs in protecting water quality by retaining canopy and groundcover in watercourse and lake protection zones (WLPZs), by preventing erosion, by preventing sediment transport, and/or by preventing sediment transport to stream channels?

Modified Completion Report Monitoring 2001 to 2004

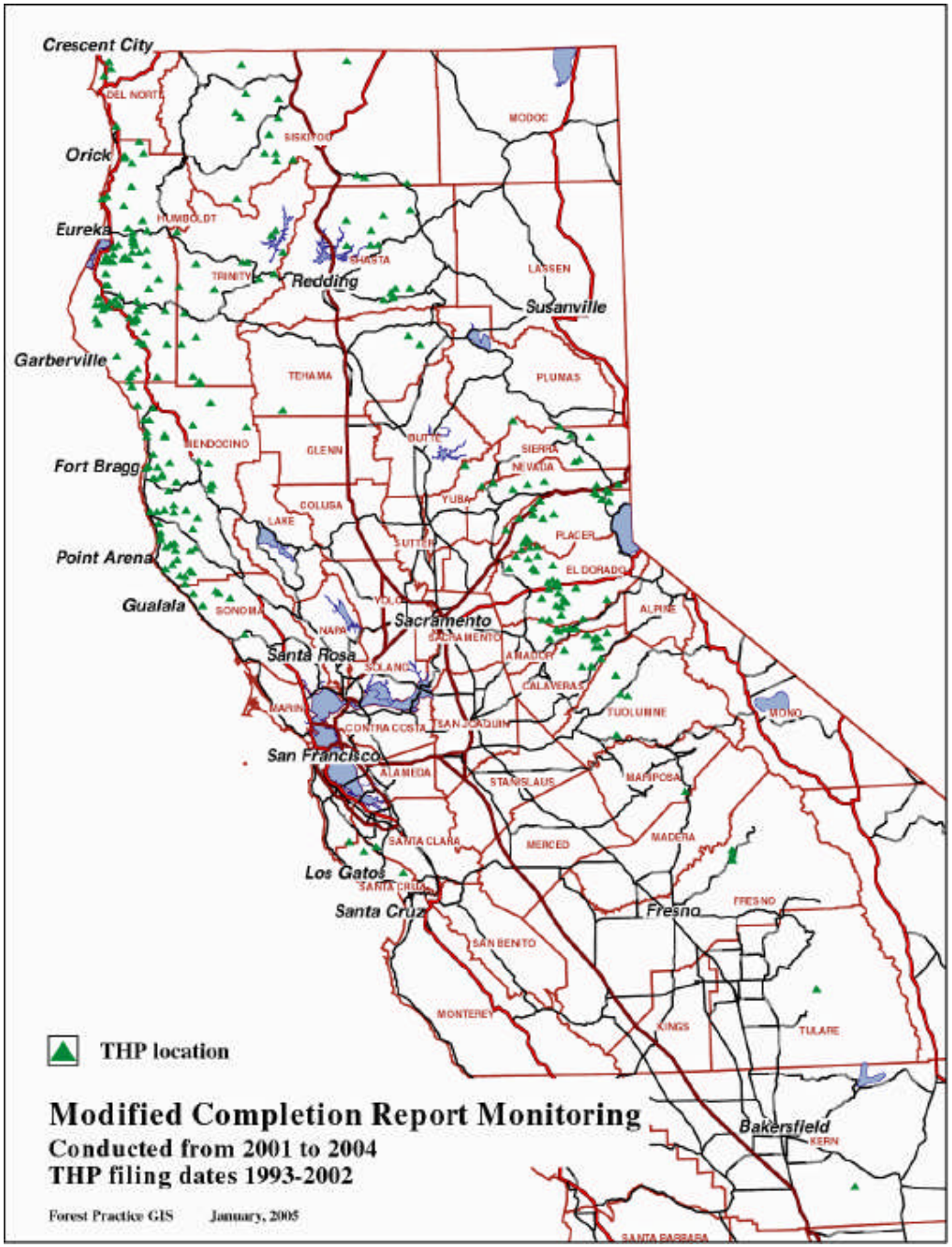
- Sample size was 12.5% of THPs undergoing Completion Report field inspections.
- Used CDF's Forest Practice Inspectors and professionals from other agencies to collect the monitoring data.
  (see Acknowledgements on pages viii and ix)

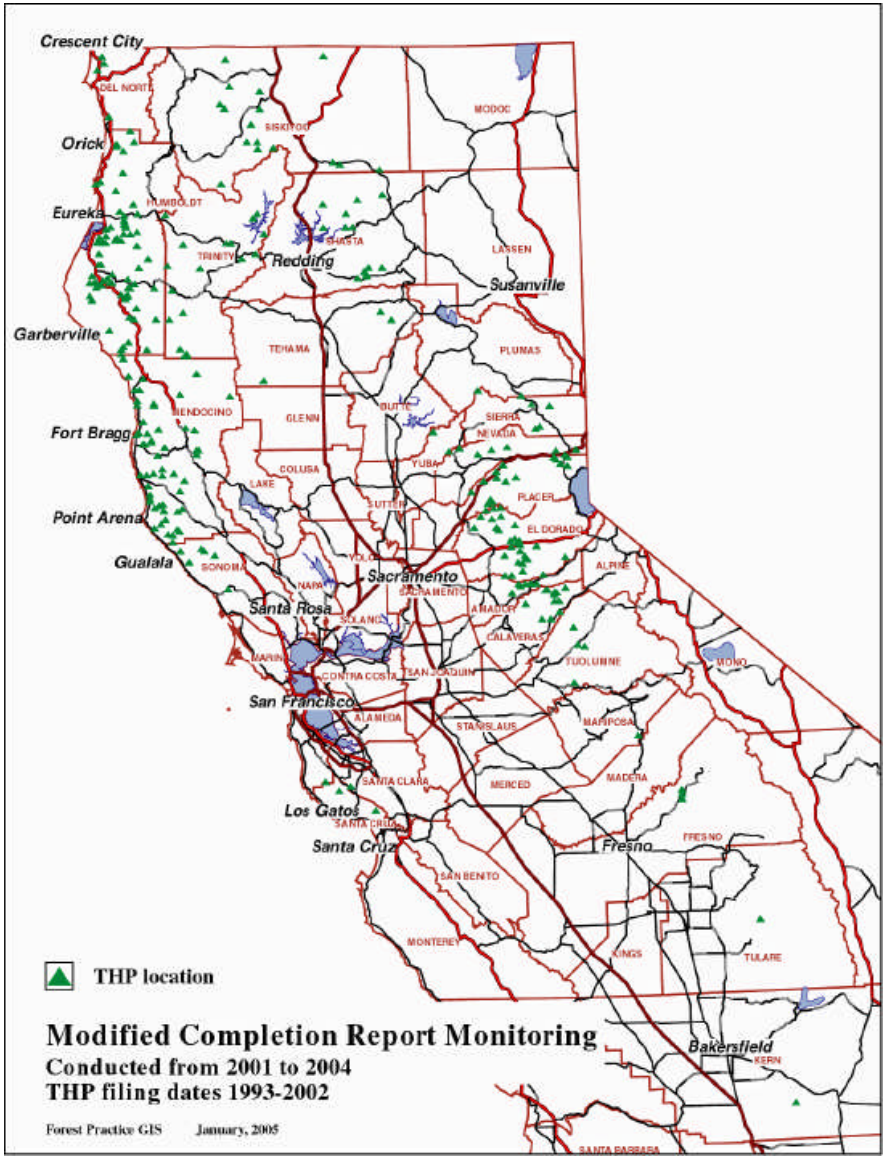

California Dept. of Forestry and Fire Protection
CDF Administrative Regions
Modified Completion Report Monitoring
2001-2004
THP filing dates: 1993-2002
THP locations
North Coast Region 1 (Coast)
Cascade Region 2 (Inland North)
Central Sierra Region 4 (Inland South)
Southern Region 3 (No THPs, therefore not included in study)
Forest Practice
GIS
Santa Rosa, California
February 17, 2006

Modified Completion Report Monitoring 2001 to 2004



- 281 THPs Sampled
  - 52% Coast District (R-1)
  - 48% Inland Districts (R-2 & R-4)


Crescent City
Orick
Eureka
Garberville
Fort Bragg
Point Arena
Gualala
Santa Rosa
Sacramento
San Francisco
Los Gatos
Santa Cruz
Redding
Susanville
Fresno
Bakersfield
DEL NORTE
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
NEVADA
COLUSA
YUBA
LAKE
SUTTER
PLACER
EL DORADO
SONOMA
NAPA
YOLO
ALPINE
SACRAMENTO
AMADOR
SOLANO
CALAVERAS
MARIN
CONTRA COSTA
SAN JOAQUIN
TUOLUMNE
MONO
ALAMEDA
STANISLAUS
MARIPOSA
SANTA CLARA
MERCED
MADERA
SANTA CRUZ
FRESNO
SAN BENITO
MONTEREY
KINGS
TULARE
KERN
SANTA BARBARA
THP location
Modified Completion Report Monitoring
Conducted from 2001 to 2004
THP filing dates 1993-2002
Forest Practice GIS
January, 2005


Crescent City
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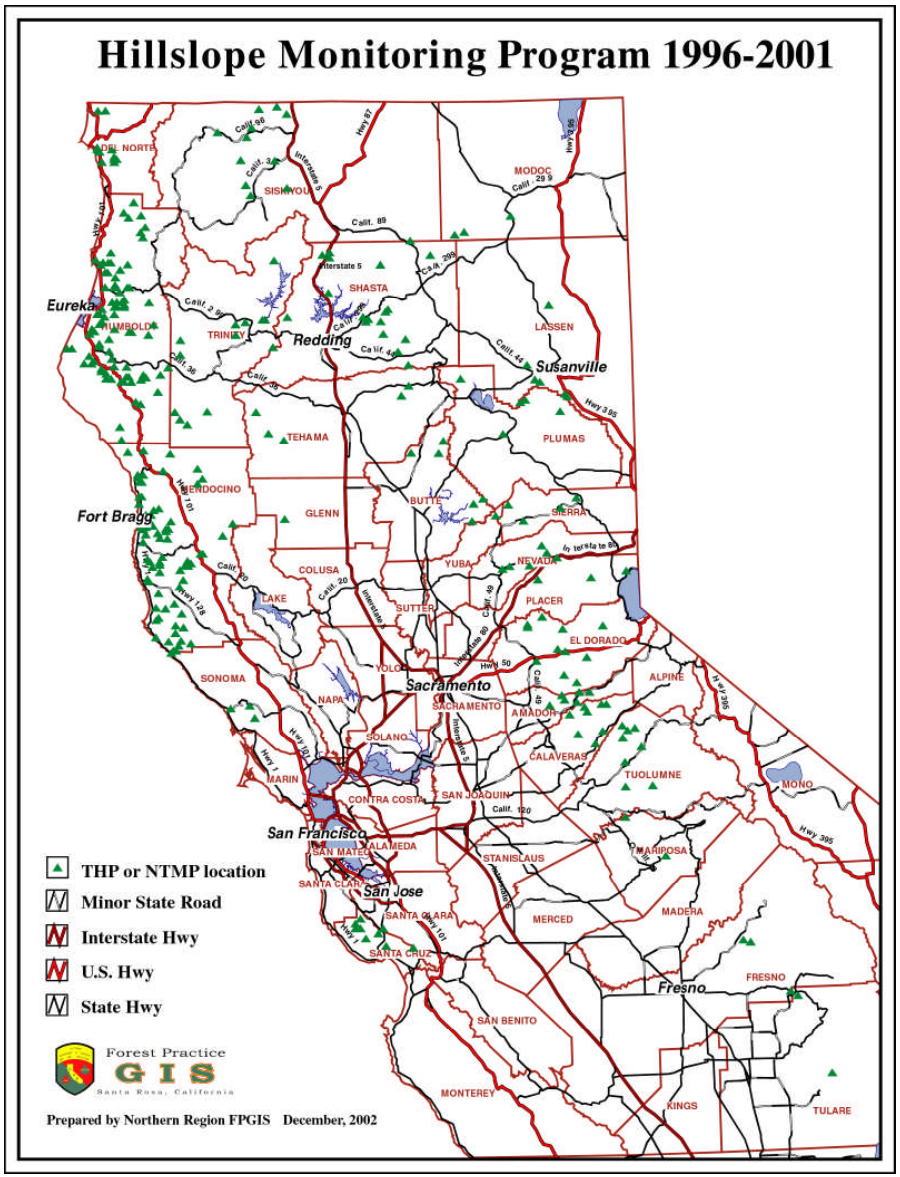

Hillslope Monitoring Program 1996-2001
Eureka
Fort Bragg
Redding
Susanville
Sacramento
San Francisco
San Jose
Fresno
THP or NTMP location
Minor State Road
Interstate Hwy
U.S. Hwy
State Hwy
Forest Practice GIS
Santa Rosa, California
Prepared by Northern Region FPGIS December, 2002

Modified Completion Report Monitoring

- Watercourse and Lake Protection Zones (WLPZs)
  - WLPZ Percent Total Canopy
  - WLPZ Erosion Features
- Roads
- Watercourse Crossings

Modified Completion Report Monitoring

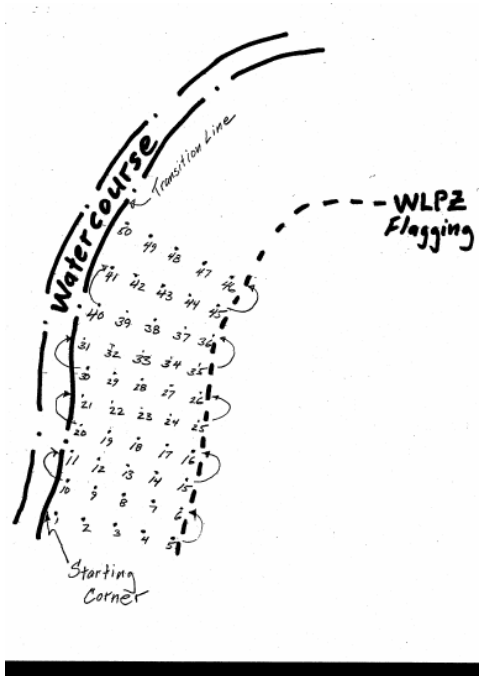
WLPZ Canopy

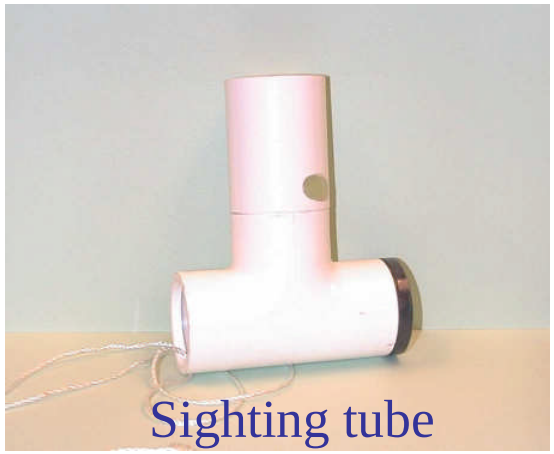
- 281THPs sampled, 187 with WLPZs.

Modified Completion Report Monitoring

WLPZ Canopy

- Randomly located 200 ft WLPZ segments for Class I and II watercourses.
- A 50 point grid pattern and a sighting tube are used for measurement.




Sighting tube

Average Percent Total Canopy

Class I & II WLPZs	**Overall**	**No Harvest**	**Harvest**
Coast (Region 1)	**84%** n = 110	**86%** n = 55	**82%** n = 55
Inland North (Region 2)	**68%** n = 49	**72%** n = 12	**67%** n = 37
Inland South (Region 4)	**73%** n = 28	**69%** n = 15	**77%** n = 13

Average Percent Total Canopy

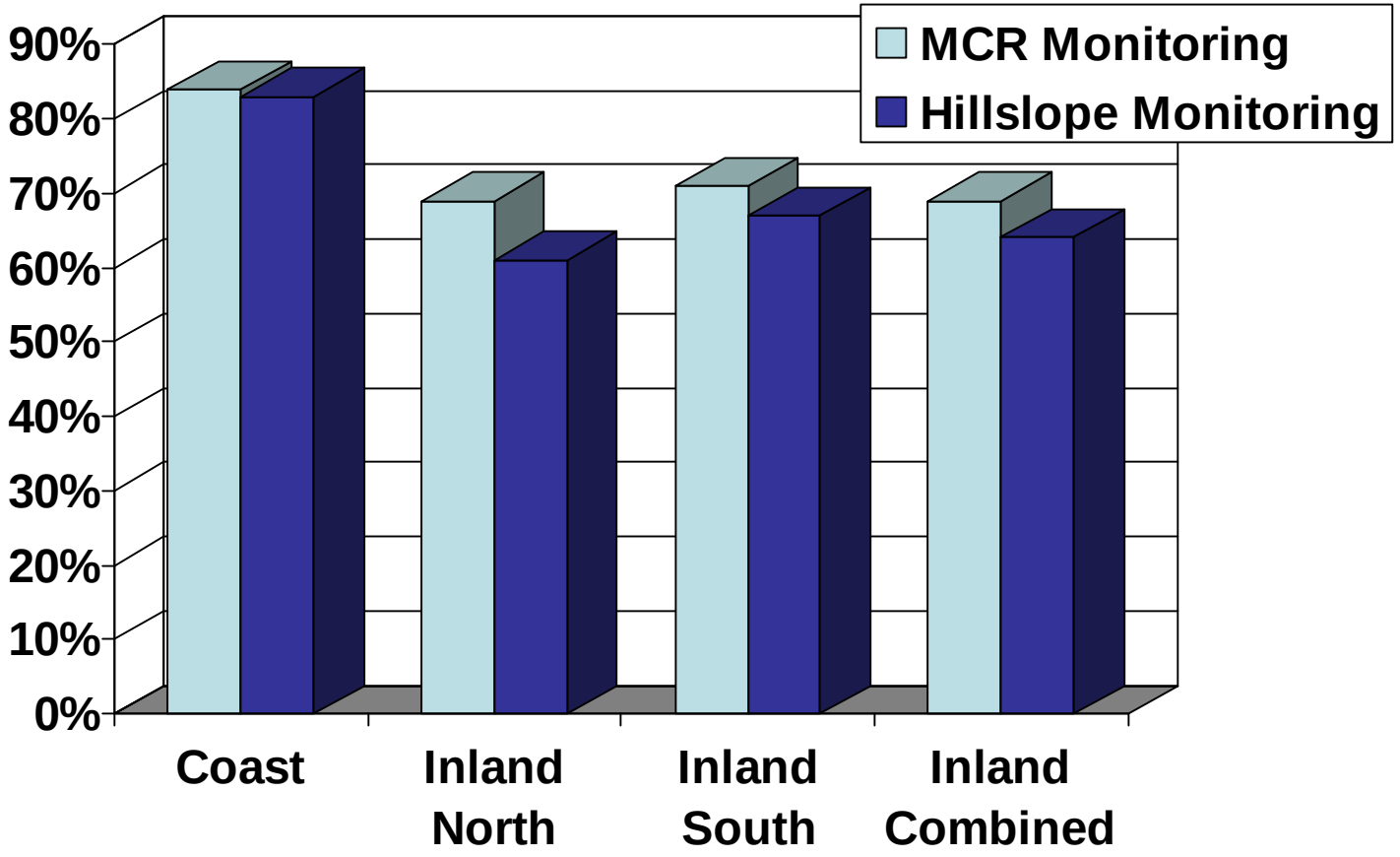
Class I WLPZs	**Overall**	**No Harvest**	**Harvest**
Coast (Region 1)	**84%** n = 29	**83%** n = 14	**84%** n = 15
Inland North (Region 2)	**69%** n = 18	**74%** n = 3	**68%** n = 15
Inland South (Region 4)	**71%** n = 5	**65%** n = 2	**75%** n = 3

Average Percent Total Canopy

Class II WLPZs	**Overall**	**No Harvest**	**Harvest**
Coast (Region 1)	**84%** n = 81	**87%** n = 41	**81%** n = 15
Inland North (Region 2)	**67%** n = 31	**70%** n = 9	**65%** n = 22
Inland South (Region 4)	**73%** n = 23	**70%** n = 13	**78%** n = 10

Comparison of Class I

WLPZ Average Percent Total Canopy Results



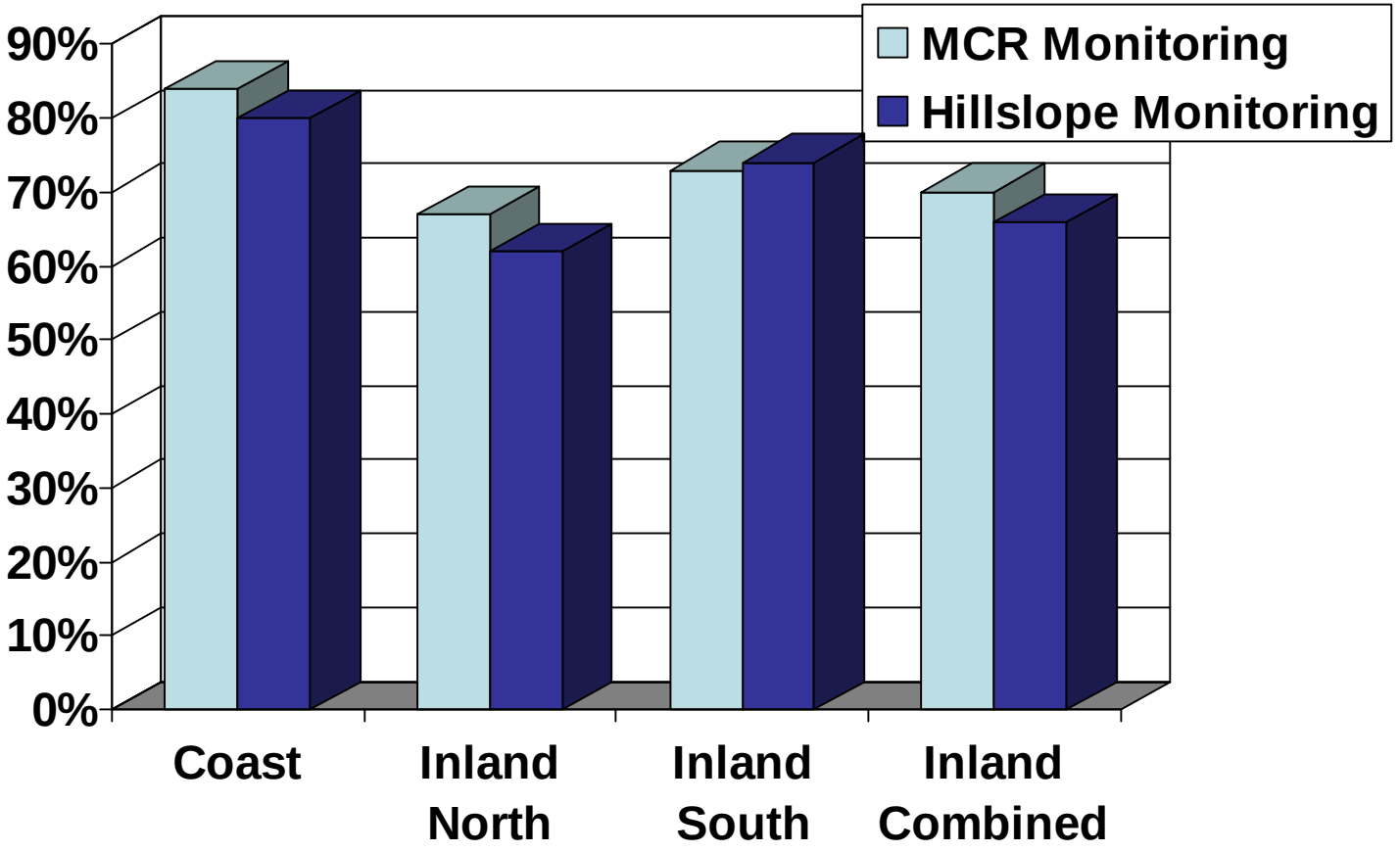
Comparison of Class I

WLPZ Average Percent Total Canopy Results

Class I Comparison	MCR Monitoring (2001-2004) Class I WLPZ percent total canopy	Hillslope Monitoring (1999-2001) Class I WLPZ percent total canopy
Coast (Region 1)	84% n = 29	83% n = 27
Inland North (Region 2)	69% n = 18	61% n = 17
Inland South (Region 4)	71% n = 5	67% n = 13
Inland (Regions 2&4 Combined)	69% n = 23	64% n = 30

Comparison of Class II

WLPZ Average Percent Total Canopy Results



Comparison of Class II

WLPZ Average Percent Total Canopy Results

Class II Comparison	MCR Monitoring (2001-2004) Class II WLPZ percent total canopy	Hillslope Monitoring (1999-2001) Class II WLPZ percent total canopy
Coast (Region 1)	84% n = 81	80% n = 109
Inland North (Region 2)	67% n = 31	62% n = 46
Inland South (Region 4)	73% n = 23	74% n = 19
Inland (Regions 2&4 Combined)	70% n = 54	66% n = 65

WLPZ
Erosion Features

- Of 187 WLPZs sampled, 19 WLPZs (10%) had one or more erosion features.

- Of the 19 WPLZs with erosion features, only 2 WLPZs (1%) had erosion features related to current timber operations.

WLPZ Erosion Features Related to Current THP

- 1 with sediment deposition from landing
- 1 with gully (<70% groundcover)

WLPZ Erosion Features
Not Related to Current Operations

- 6 related to inner gorges
- 2 related to streambank failures
- 1 sediment deposition from a scarp
- 4 related to old skid trails/roads
- 1 gully originating at county road
- 1 related to an eroding cow trail
- 1 related to a breached irrigation ditch

Modified Completion Report Monitoring

Roads

- 244 randomly-selected, one-thousand foot road segments sampled and rated for implementation .

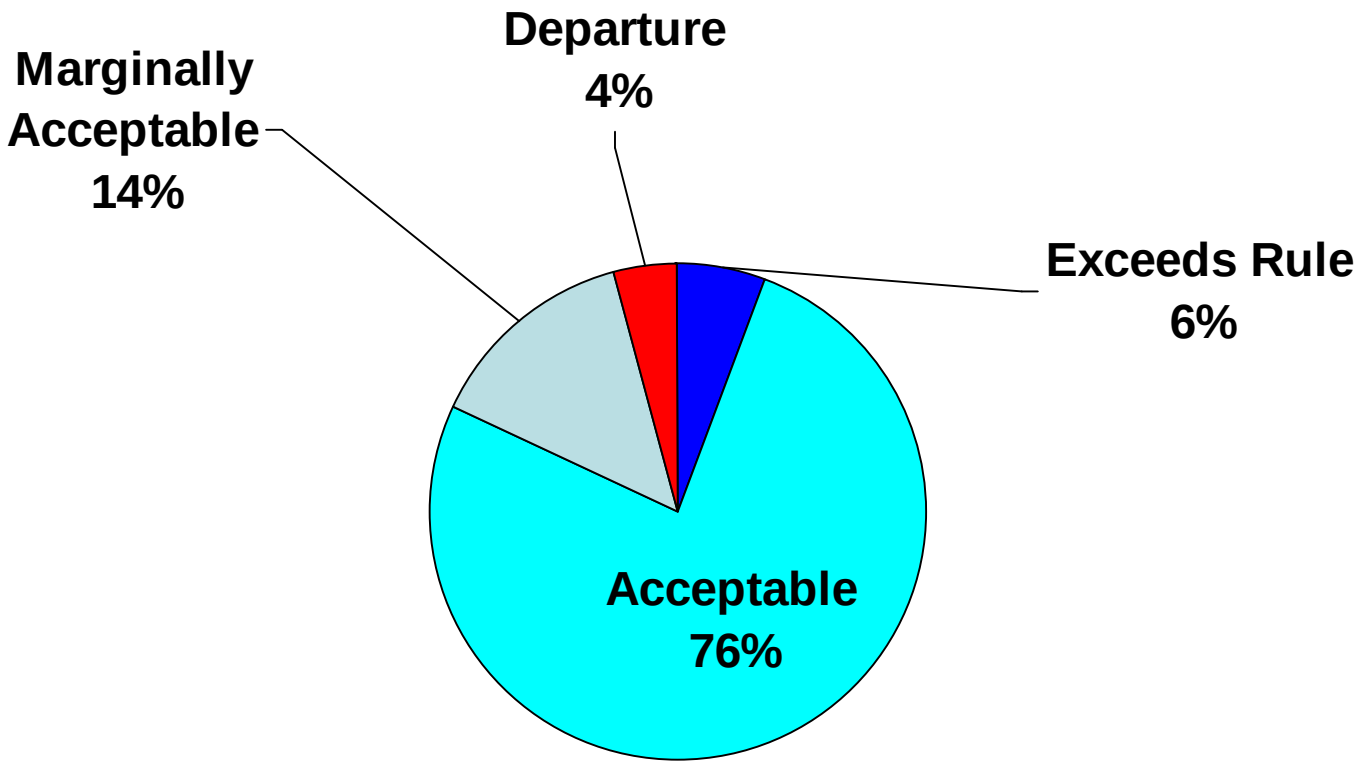
  (244,000 feet is about 46 miles)

- 1,991 road features rated for Forest Practice Rule (FPR) implementation .

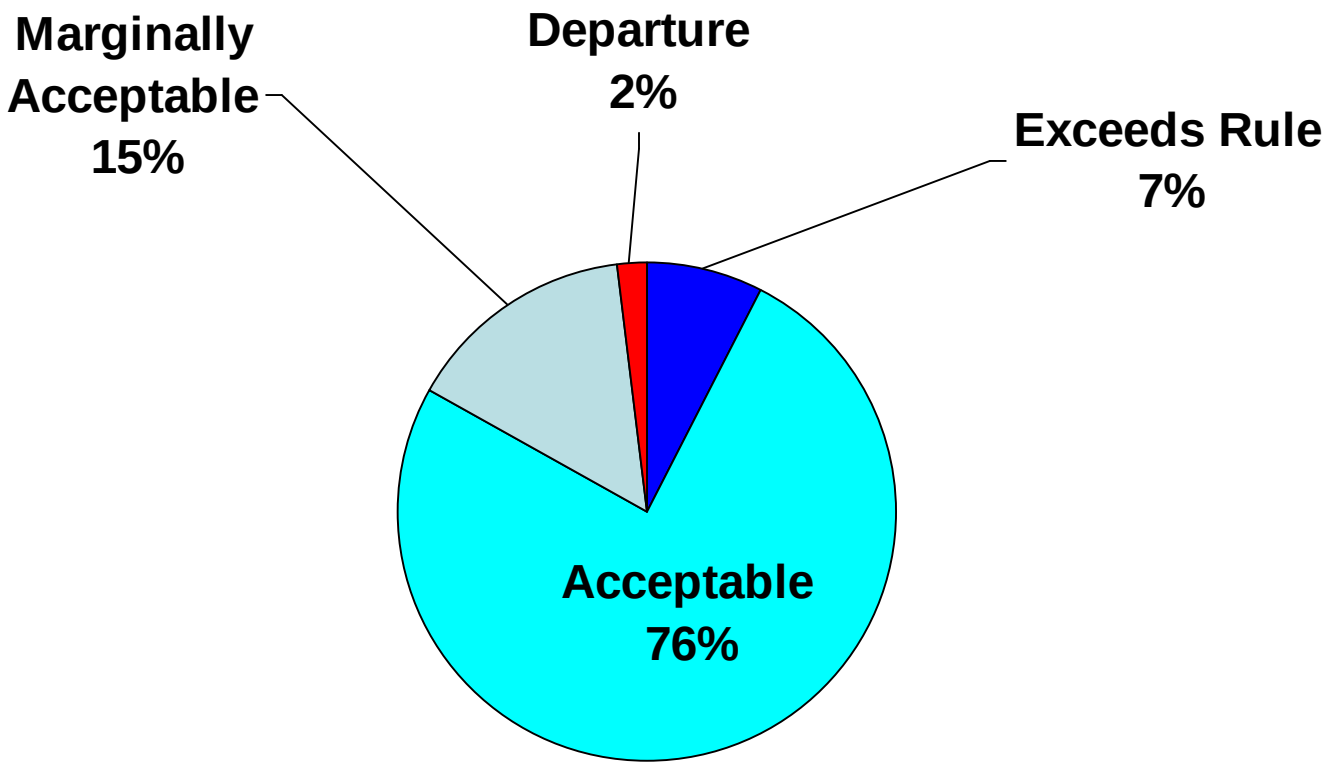
Modified Completion Report Monitoring
Roads: FPR Implementation

- 83 departures total or about 1.8 departures per mile of road.
- However, departures tend be clustered, 5 road segments (2%) account for 33 departures (40%).

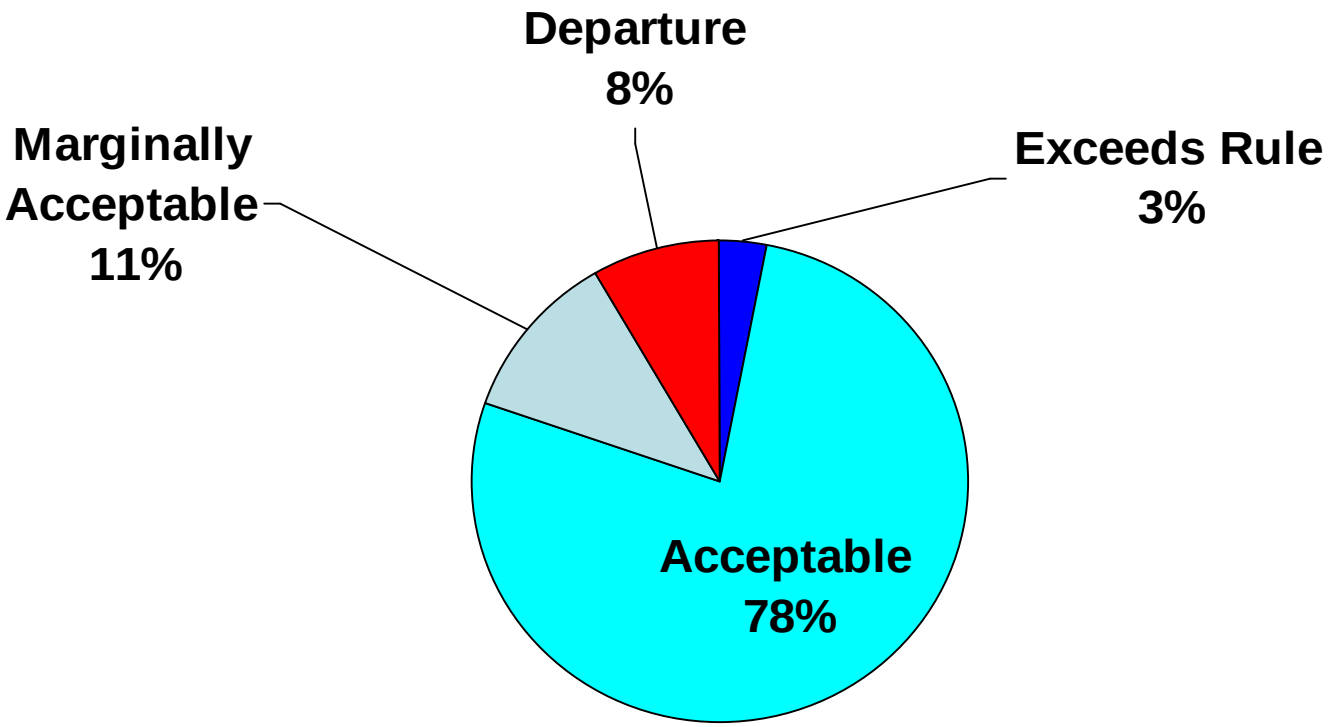
Road Features Rated for Implementation n = 1,991



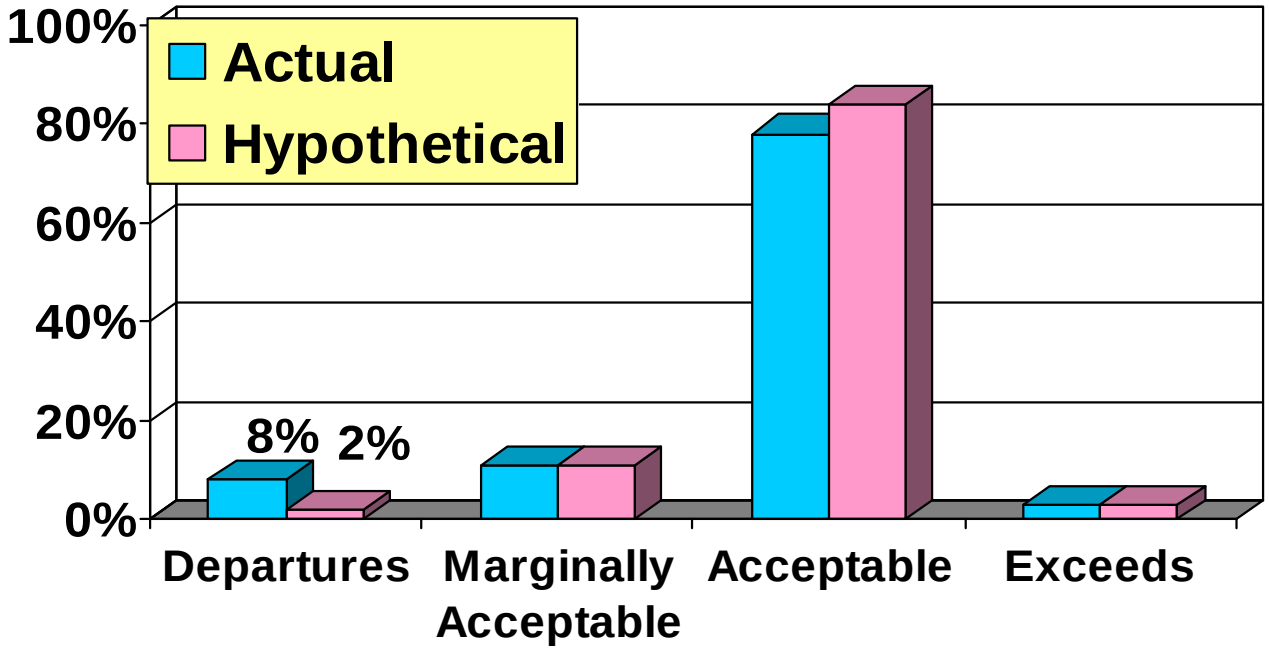
Coast (R-1) Road Features Rated for Implementation n = 1,285



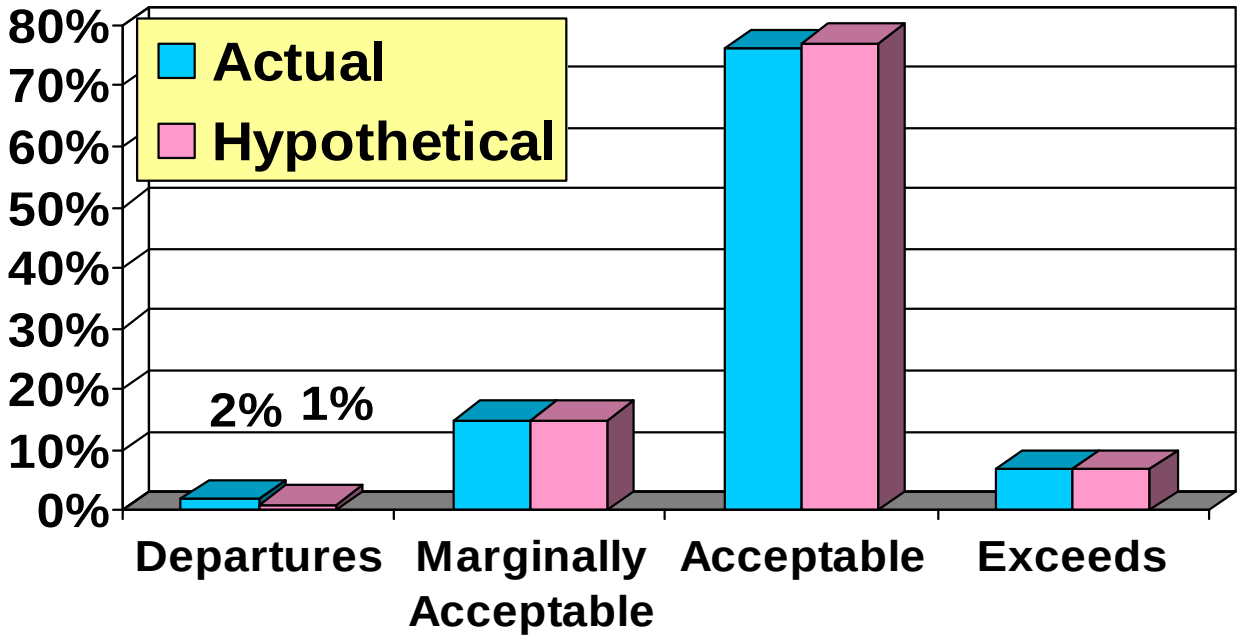
Inland (R-2 & R-4) Road Features Rated for Implementation n = 706



Inland (R-2 & R-4) Hypothetical Exercise: Find and Fix the Worst 6% of Roads Segments



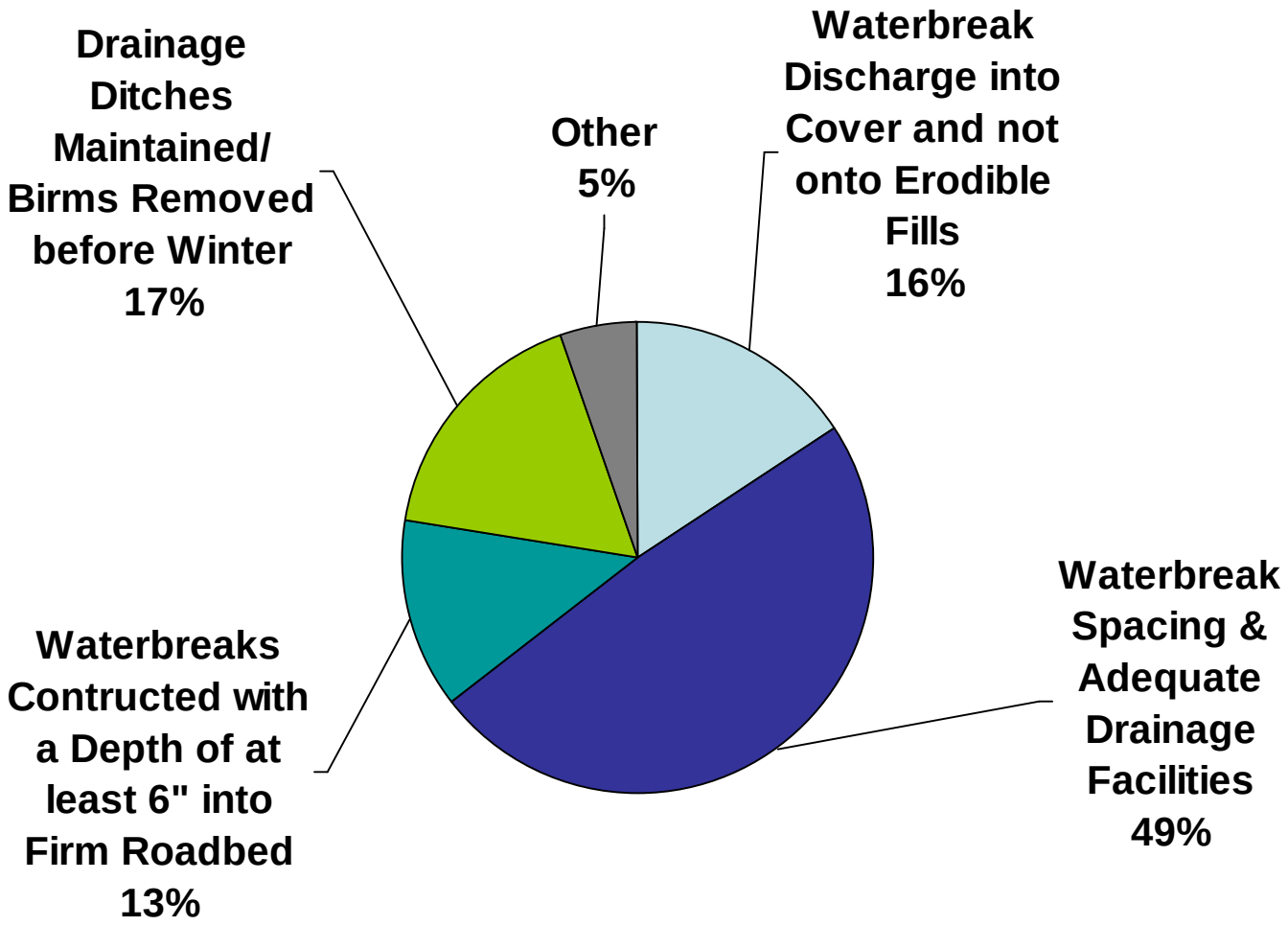
Coast (R-1) Hypothetical Exercise: Find and Fix the Worst 6% of Roads Segments



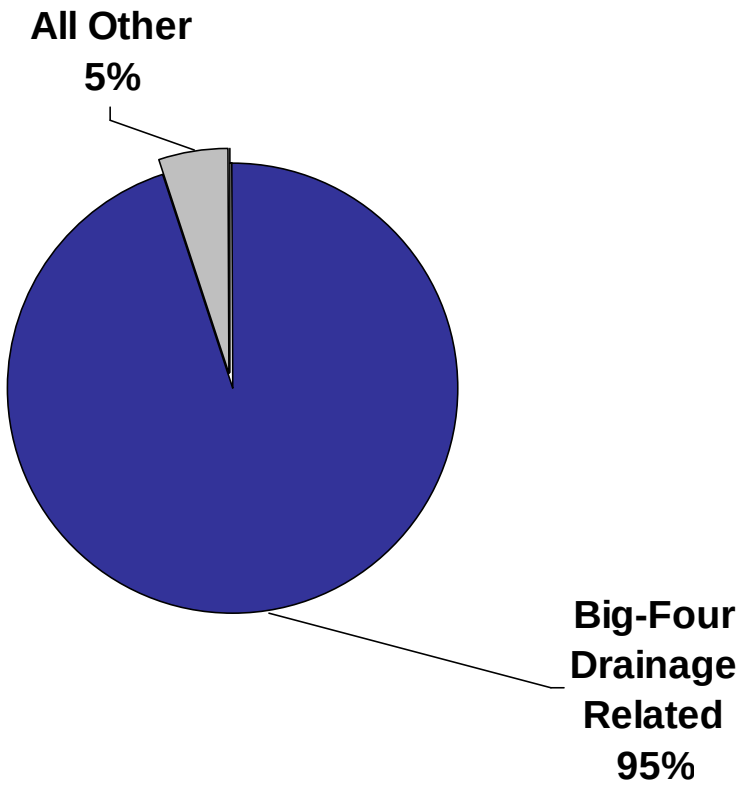
Modified Completion Report Monitoring
Roads: FPR Implementation

- Departures exhibit a pattern.
- In a word it's "**DRAINAGE**."

Road-related Departures from FPRs



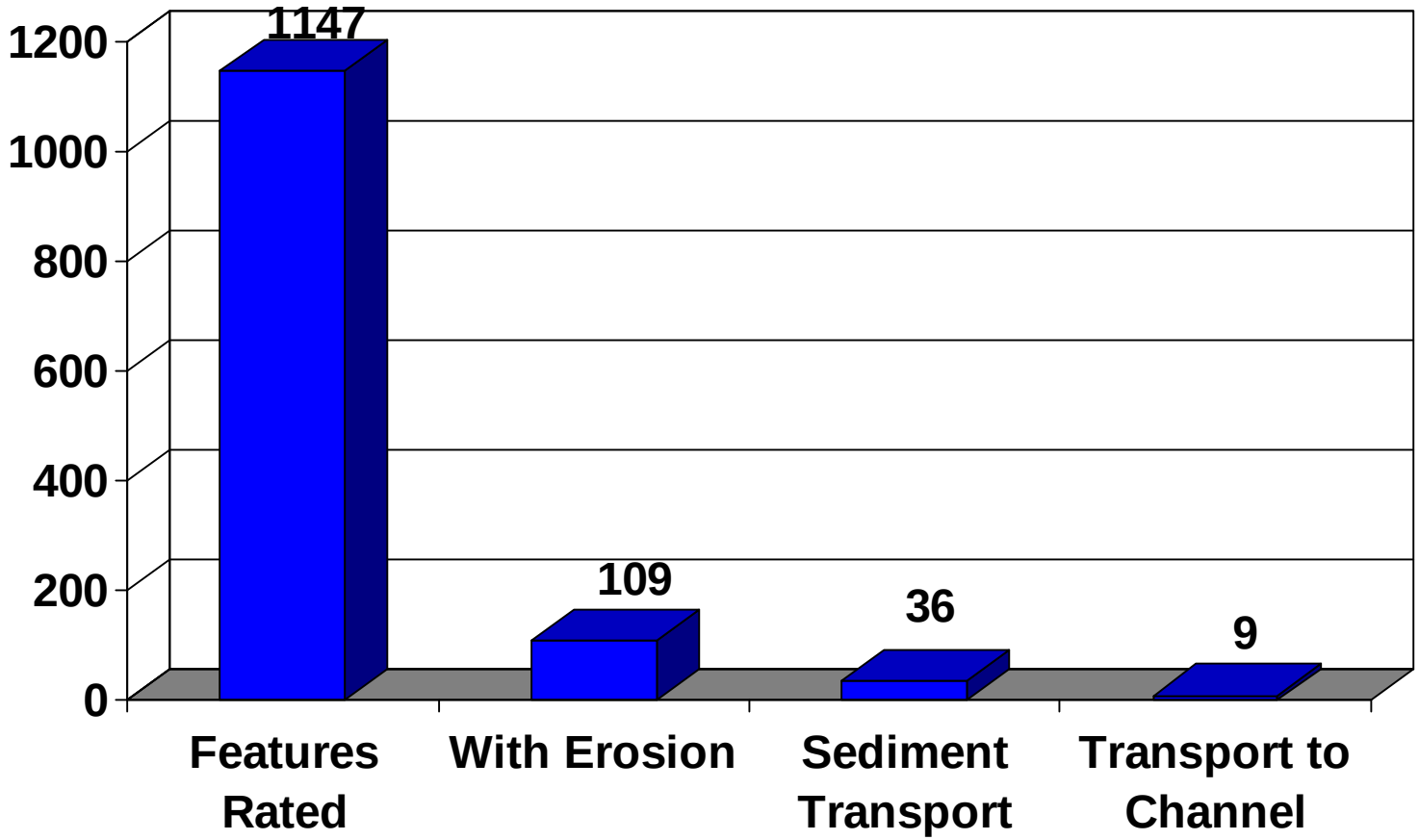
Drainage, Drainage, Drainage



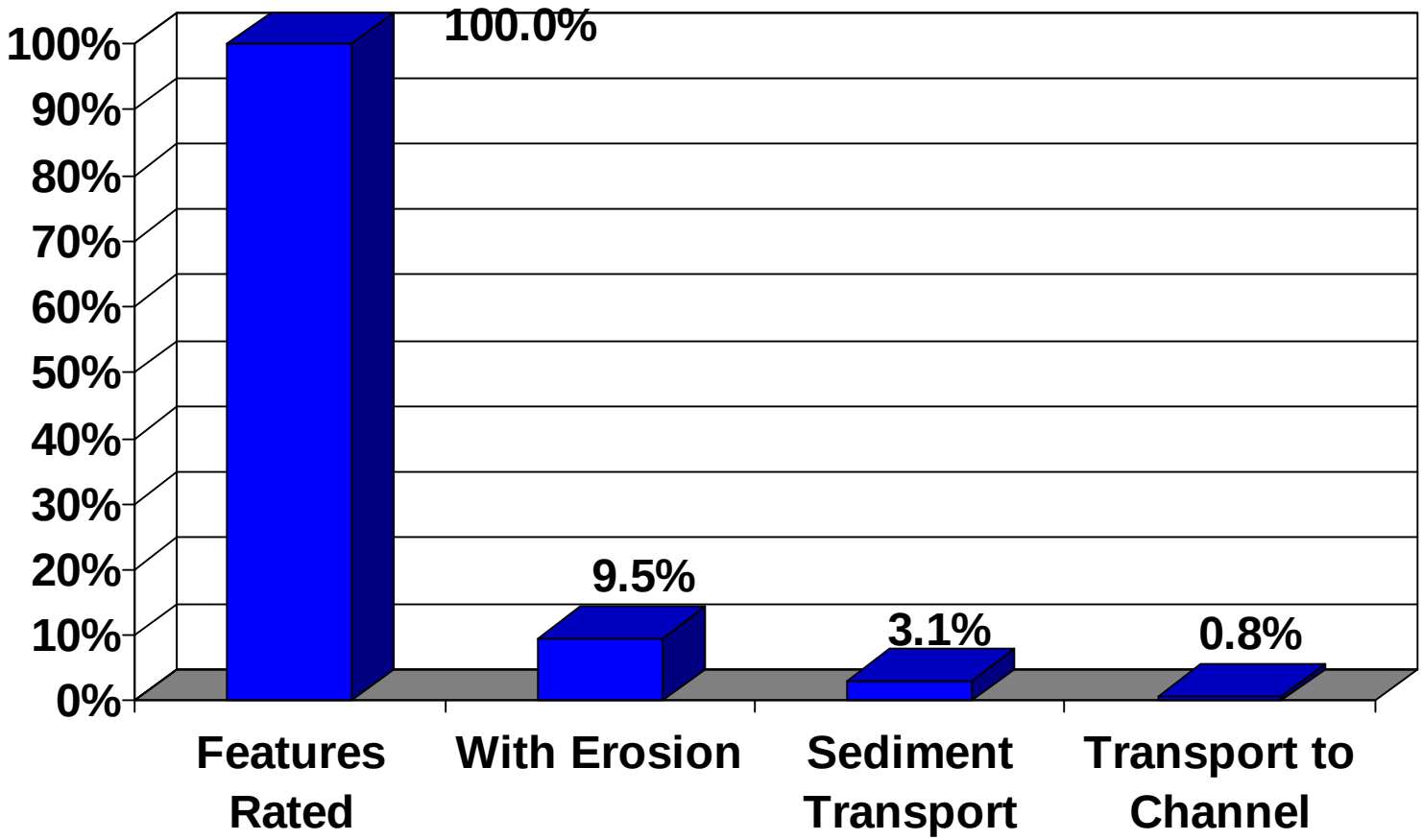
Modified Completion Report Monitoring
Roads: FPR Effectiveness

- Of 244 road segments sampled:
- 130 road segments were rated for effectiveness.
- These 130 road segments include 1,147 road-related features that were rated for effectiveness.

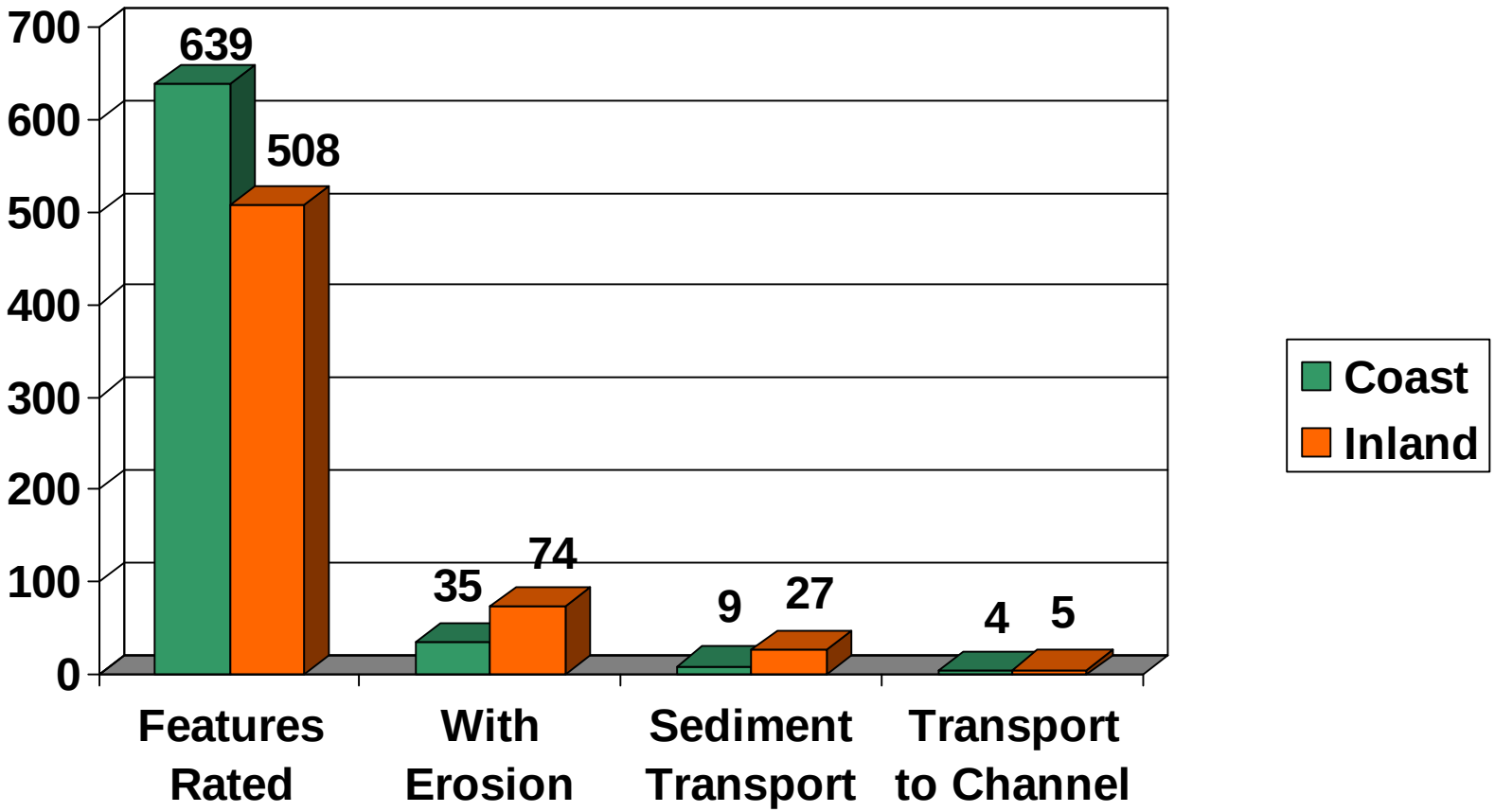
Road Features Rated for Effectiveness



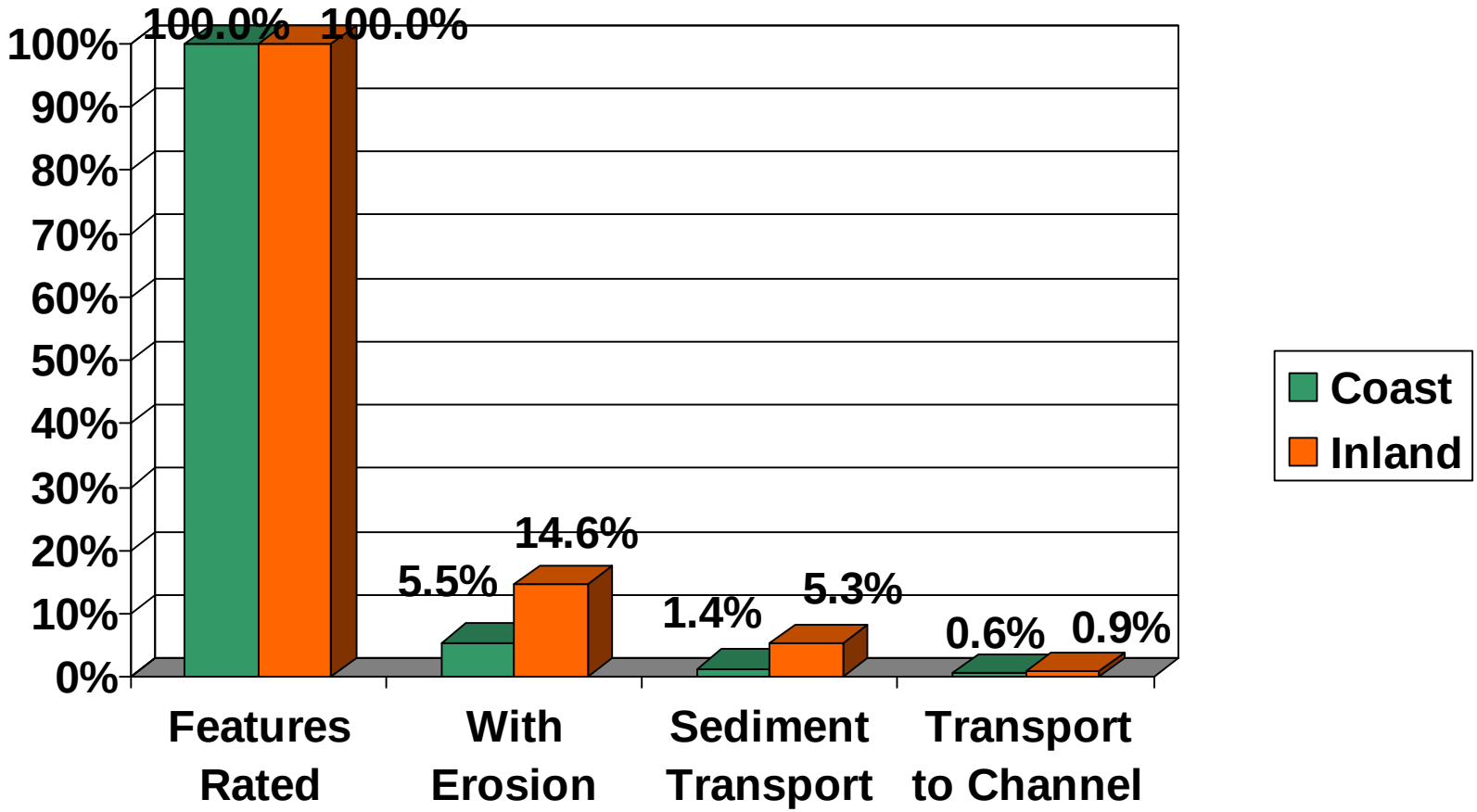
Road Features Rated for Effectiveness as Percentages



Road Features Rated for Effectiveness



Road Features Rated for Effectiveness as Percentages

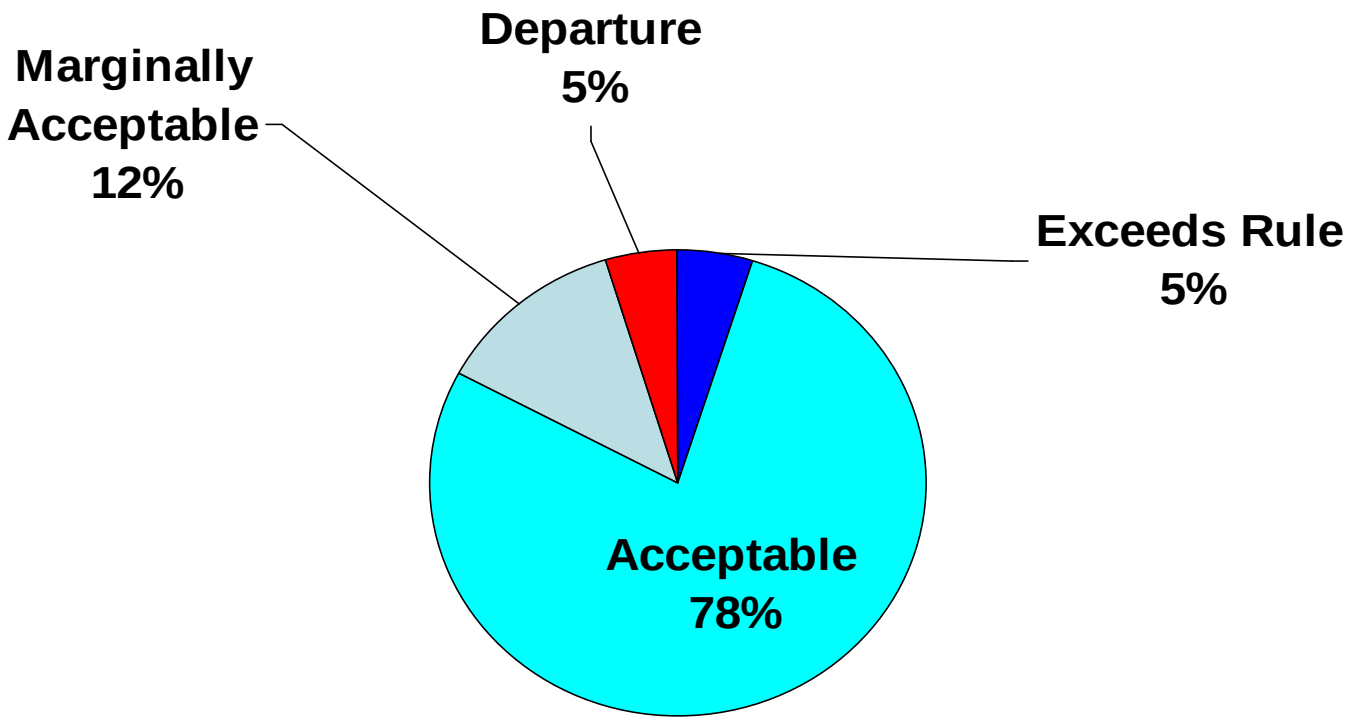


Road Feature Implementation and Effectiveness

- Better implementation results in better effectiveness, but not perfection.
- Departures are much more likely to result in erosion, sediment transport, and transport to channels.

Implementation Ratings for Road Features Rated for Effectiveness

n = 1,147



Road-related Features Implementation Rating	Erosion	Sediment Transport	Transport to Channel
Exceeds Rule/THP requirement n = 57	2%	0%	0%
Acceptable n = 893	5%	1%	1%
Marginally Acceptable n = 142	23%	9%	1%
Departure n = 55	53%	35%	11%

Transport to Channel

- Evidence of transport to channel was observed on 9 features out of 1,147 rated for effectiveness or about 0.8%.

- Implementation ratings for these 9 features included:
  - 3 Acceptable,
  - 1 Marginally Acceptable, and
  - 5 Departures

Transport to Channel

- Two features rated as acceptable and one feature rated as marginally acceptable involved watercourse crossings. One rated as acceptable involved a drainage feature and a high intensity storm.
- The 5 features rated as departures:
    - 2 involved discharges onto erodible materials or failure to discharge into cover.
    - 3 involved inadequate number of drainage facilities/structures or inadequate spacing.

Modified Completion Report Monitoring

Watercourse Crossings

Modified Completion Report Monitoring

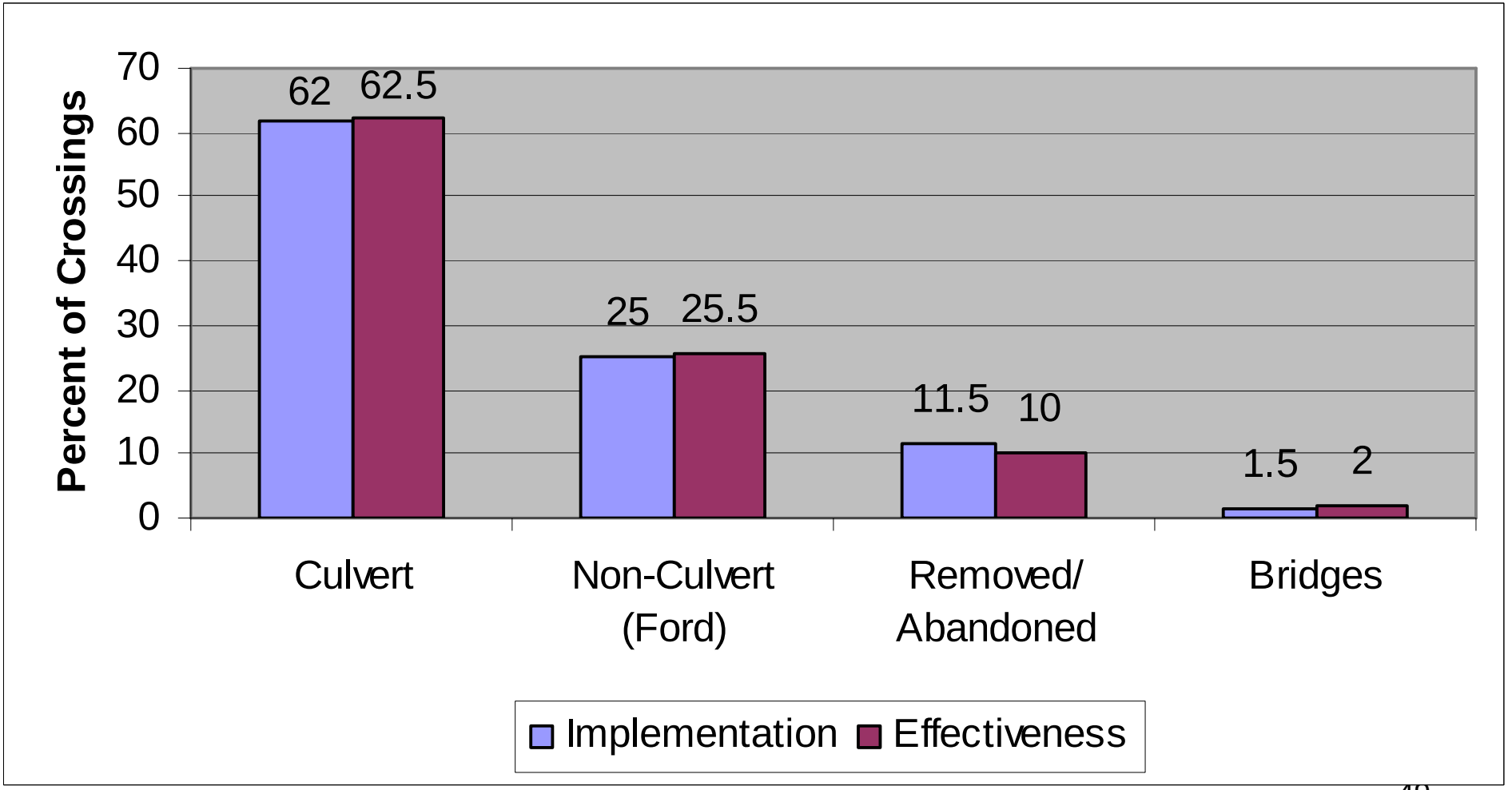
Watercourse Crossings

357 Watercourse Crossings sampled, including:

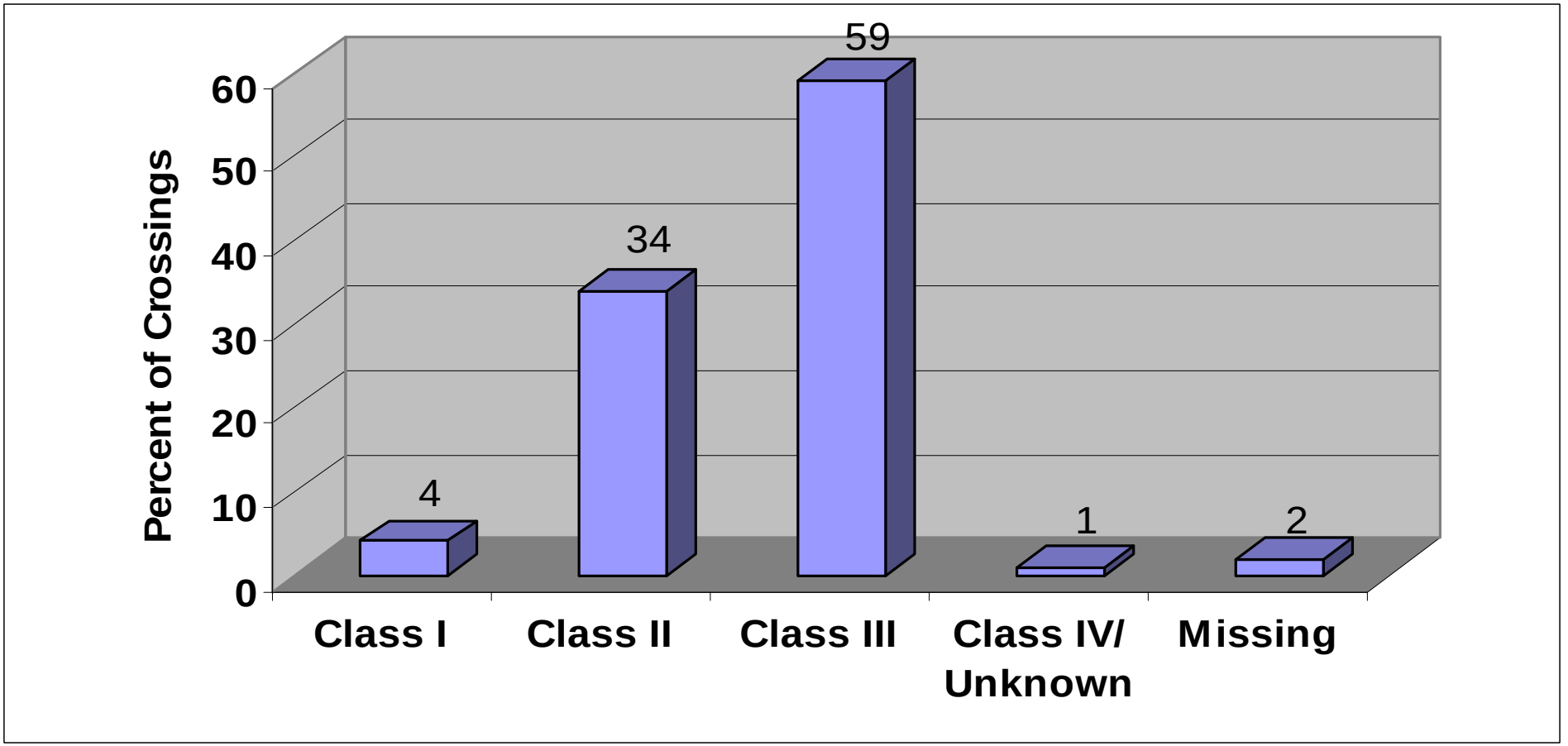
- 221 culverts
  - 149 existing culverts
  - 72 new culverts
- 89 non-culverts (fords),
- 41 removed/abandoned
- 6 bridges

289 Watercourse Crossings evaluated for effectiveness

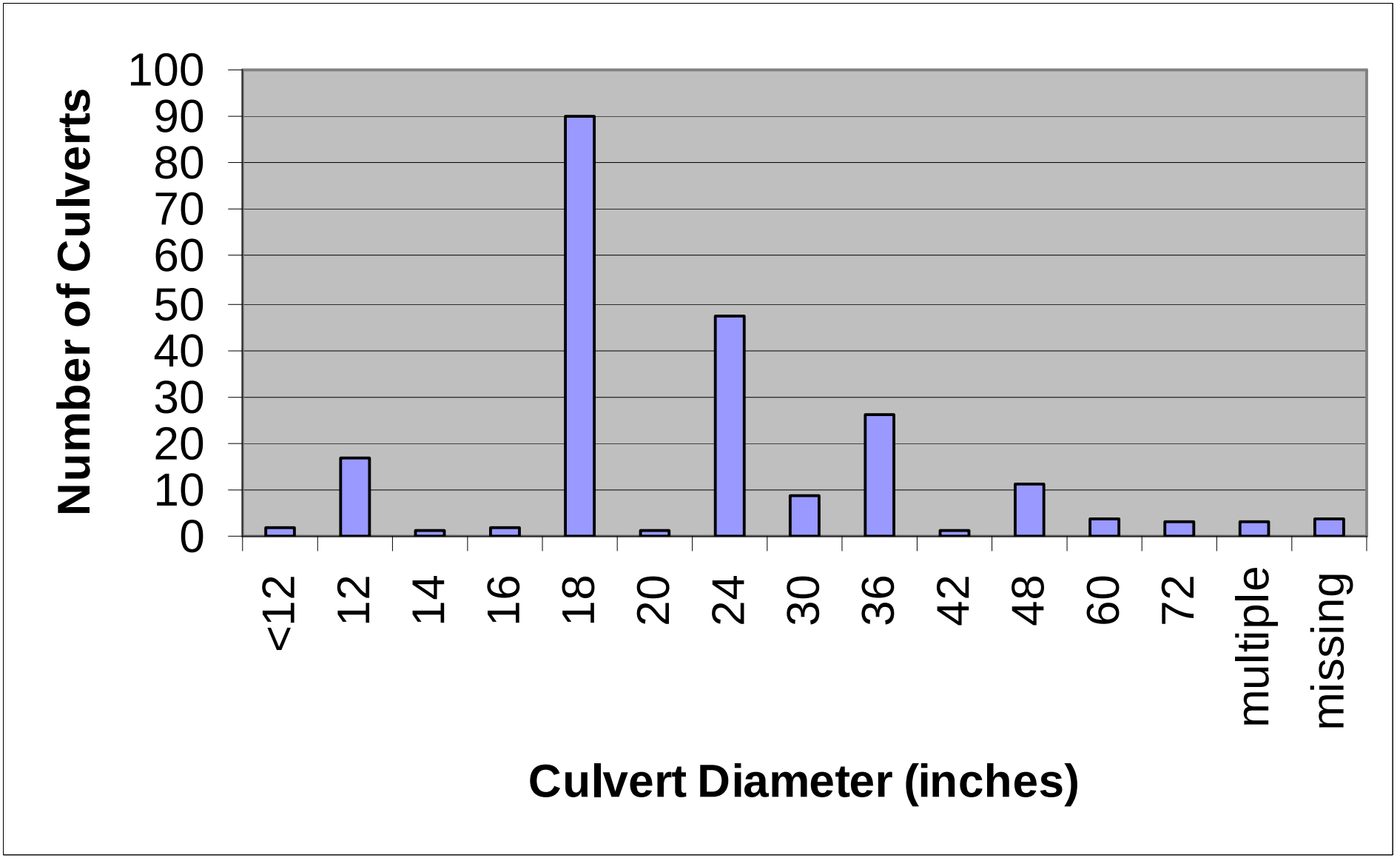
Watercourse crossing types for Implementation and Effectiveness Evaluations



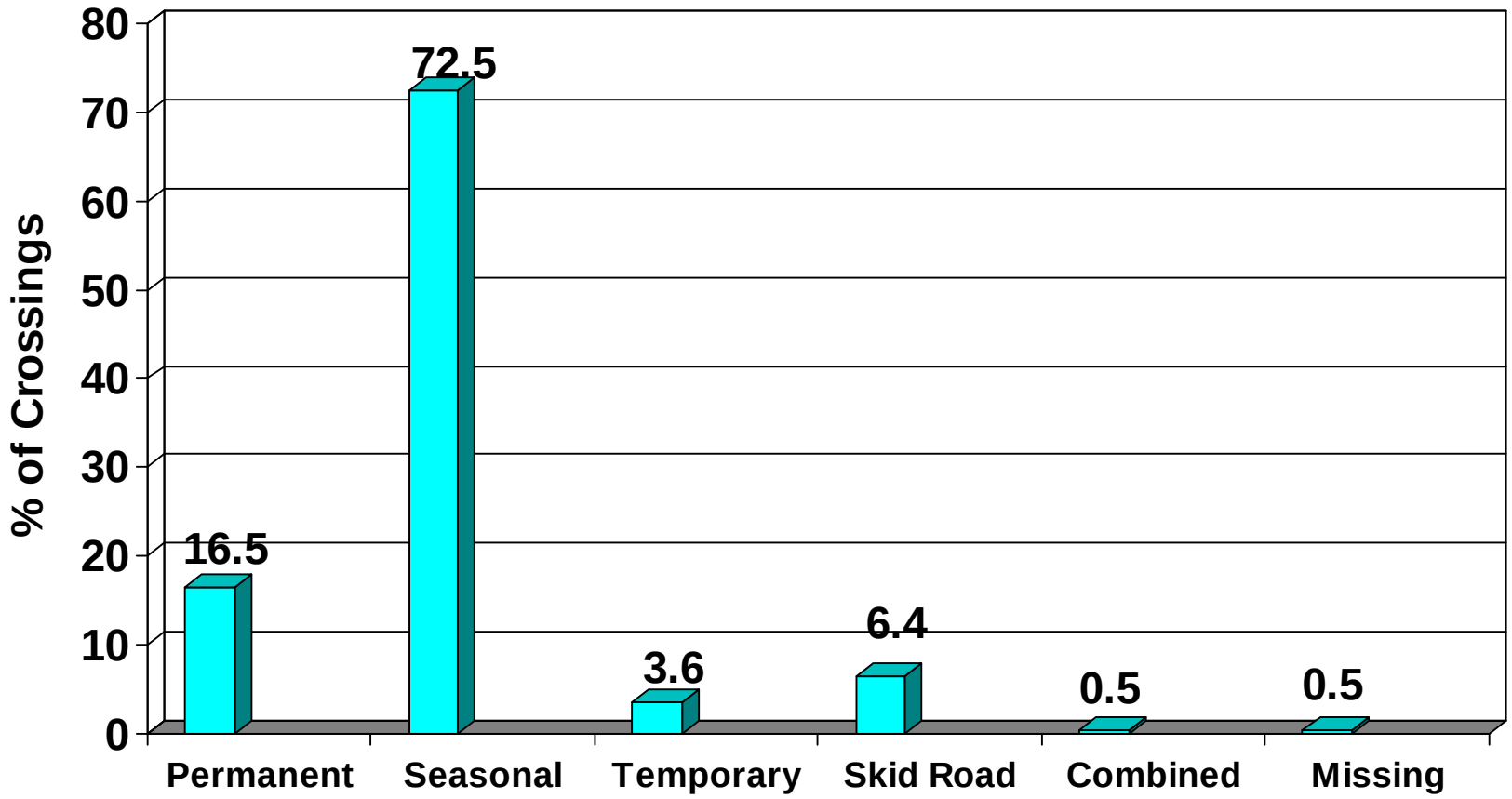
Percentages of Sampled Watercourse Classes



Culvert Size Distribution



Distribution of Crossings by Road Type



Modified Completion Report Monitoring

Watercourse Crossings: Implementation

Crossing Implementation Ratings

- Departure (D)
- Marginally Acceptable (MA)
- Acceptable (A)
- Exceeds Rule Requirement (ER)
- Not Applicable (NA)

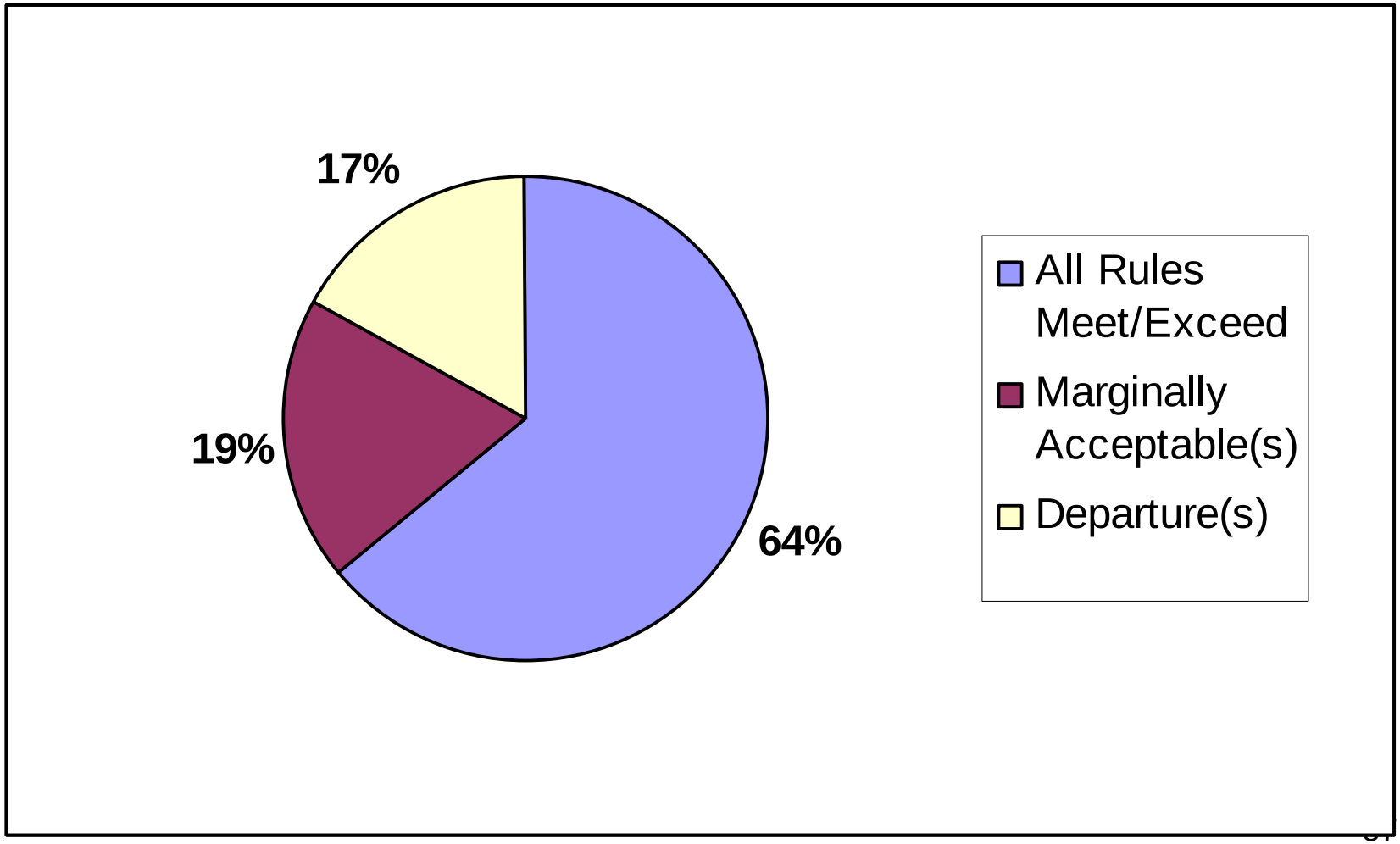
Applied to 27 Road Rules (14 CCR 923)

Applied to 3 Skid Trail Rules (14 CCR 914)

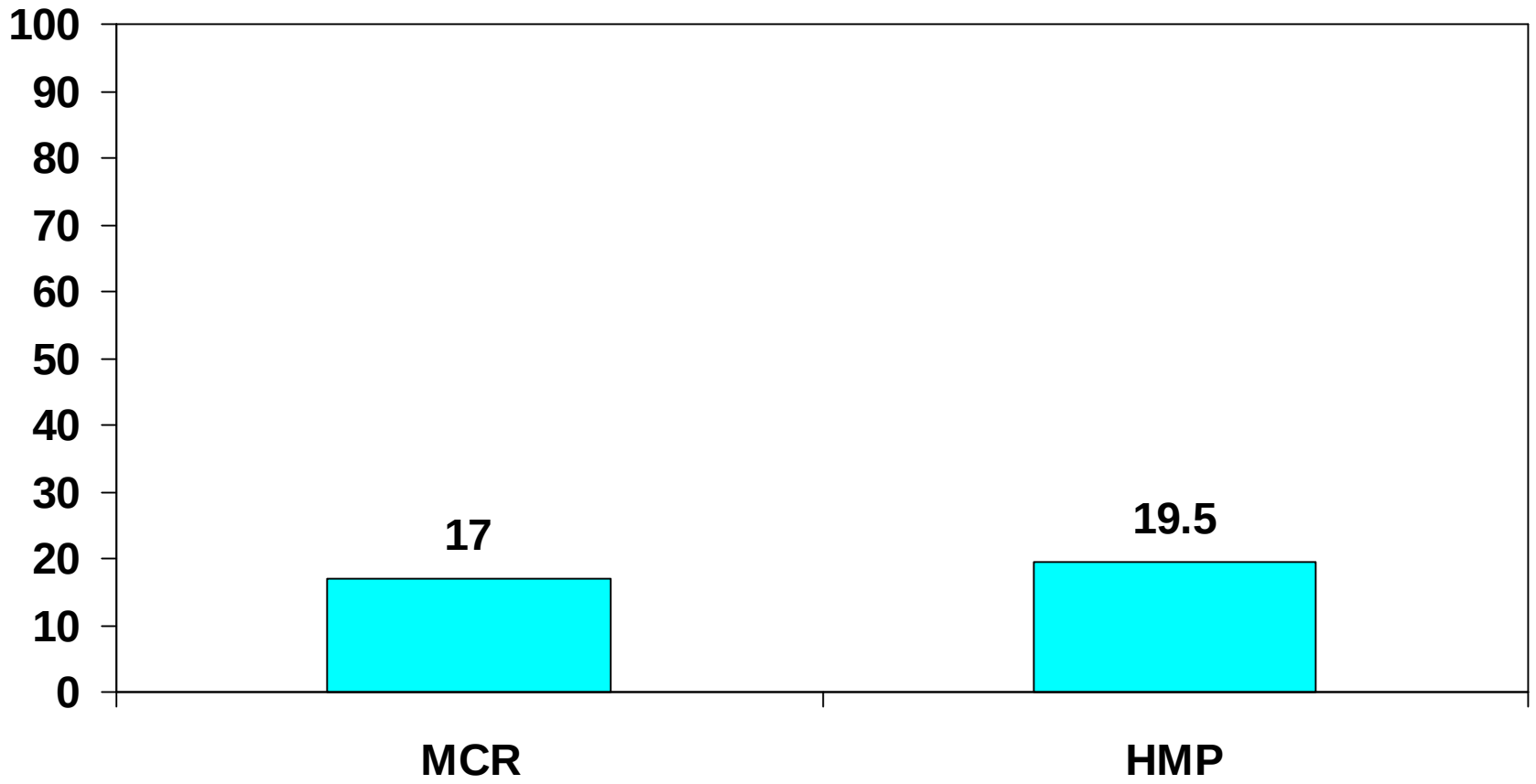
Rule Number	Rule Description	Total Obs. (w/out NA)	Departure (%)	Departure plus Marginally Acceptable (%)
923.4(n) 943.4(n) 963.4(n)	Crossing/approaches maintained to prevent diversion	246	6.9%	18.7%
923.2(i) 943.2(i) 963.2(i)	Where needed, trash racks installed to minimize blockage	65	6.2%	23.1%
923.4(m) 943.4(m) 963.4(m)	Inlet/outlet structures, etc. repaired/replaced/installed	130	5.4%	19.2%
923.3(f) 943.3(f) 963.3(f)	Crossings/fills built/maintained to prevent diversion	301	5.0%	18.3%
923.4(l) 943.4(l) 963.4(l)	Drainage structure/trash rack maintained/repaired as needed	127	4.7%	11.0%

Rule Number	Rule Description	Total Obs. (w/out NA)	Departure (%)	Departure plus Marginally Acceptable (%)
923.3(d)(1) 943.3(d)(1) 963.3(d)(1)	Removed crossings—fills excavated to adequately reform channel	91	7.4%	21.3%
923.8 943.8 963.8	Abandoned crossings—maintenance-free drainage	35	5.7%	14.3%
923.8 943.8 963.8	Abandoned crossings—minimizes concentration of runoff	35	5.7%	8.6%
923.8(b) 943.8(b) 963.8(b)	Abandoned crossings—stabilization of cuts/fills appropriate	35	5.7%	8.6%
923.8(c) 943.8(c) 963.8(c)	Abandoned crossings—grading of road for dispersal of flow	36	5.6%	11.1%

MCR Crossing Implementation



Percent of Crossings with One or More Departures (MCR) or Major Departures (HMP)



Modified Completion Report Monitoring

Watercourse Crossings: Effectiveness

Crossing Effectiveness Categories

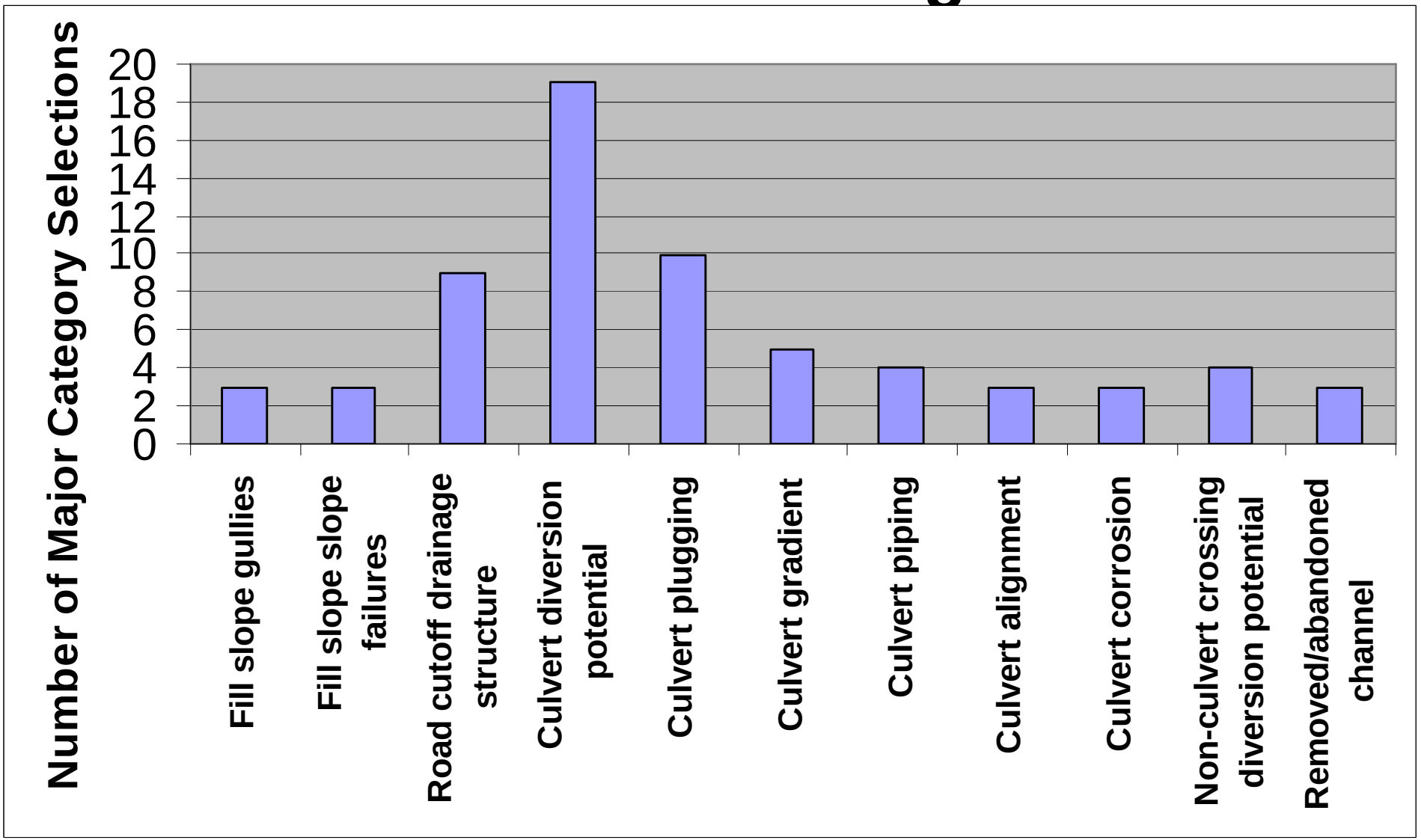
27 Features Rated for Effectiveness fell under the following 5 categories:

- Fill slopes (3)
- Road surface drainage to the crossing (5)
- Culvert design/configuration (10)
- Non-culverted crossings (3)
- Removed/Abandoned crossings (6)

Crossing Effectiveness Categories

- Not Applicable (NA)
- Not a problem (none or slight)
- Minor problem
- Major problem

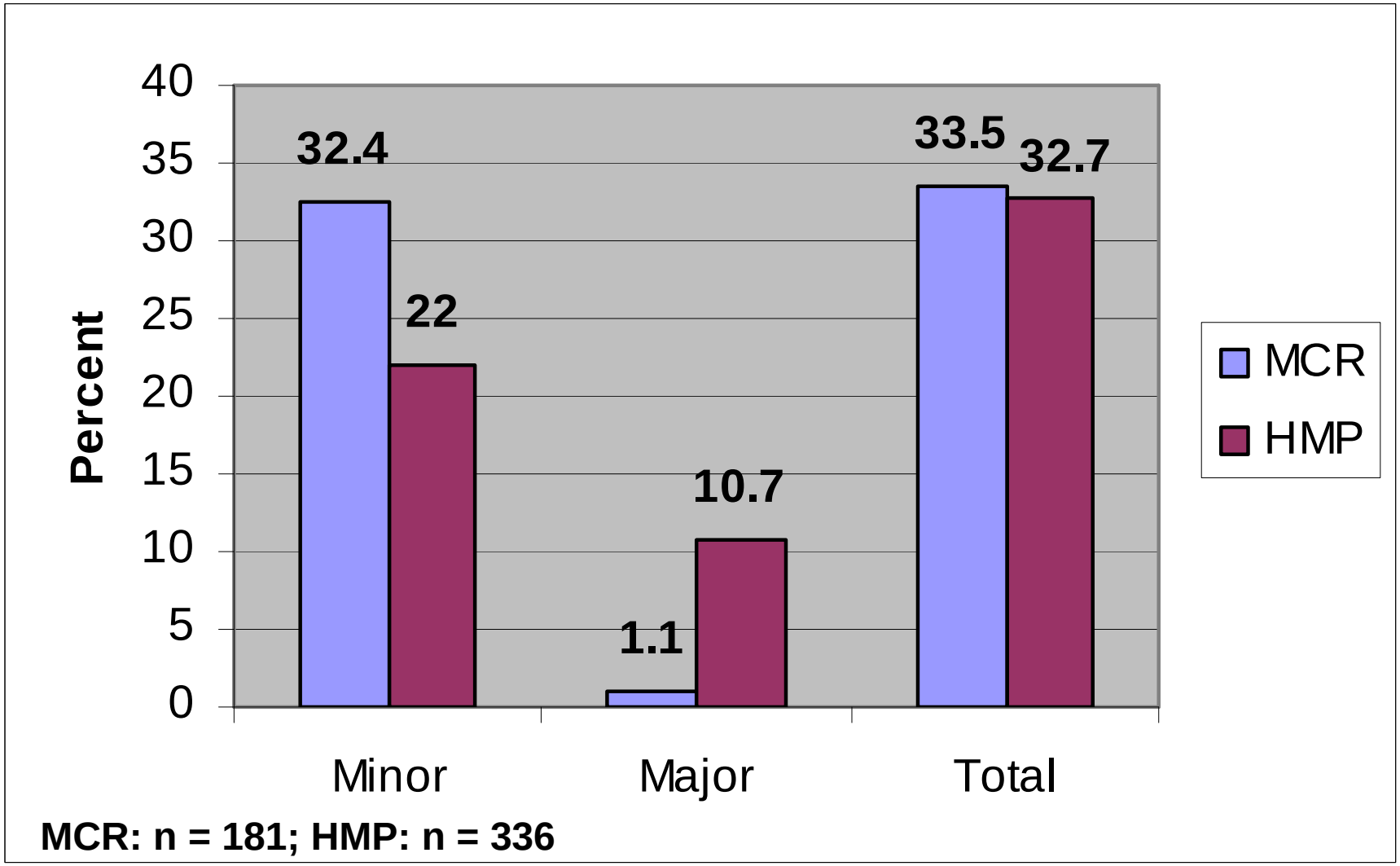
Counts for Major Problem Effectiveness Categories



76 major problems from 53 crossings

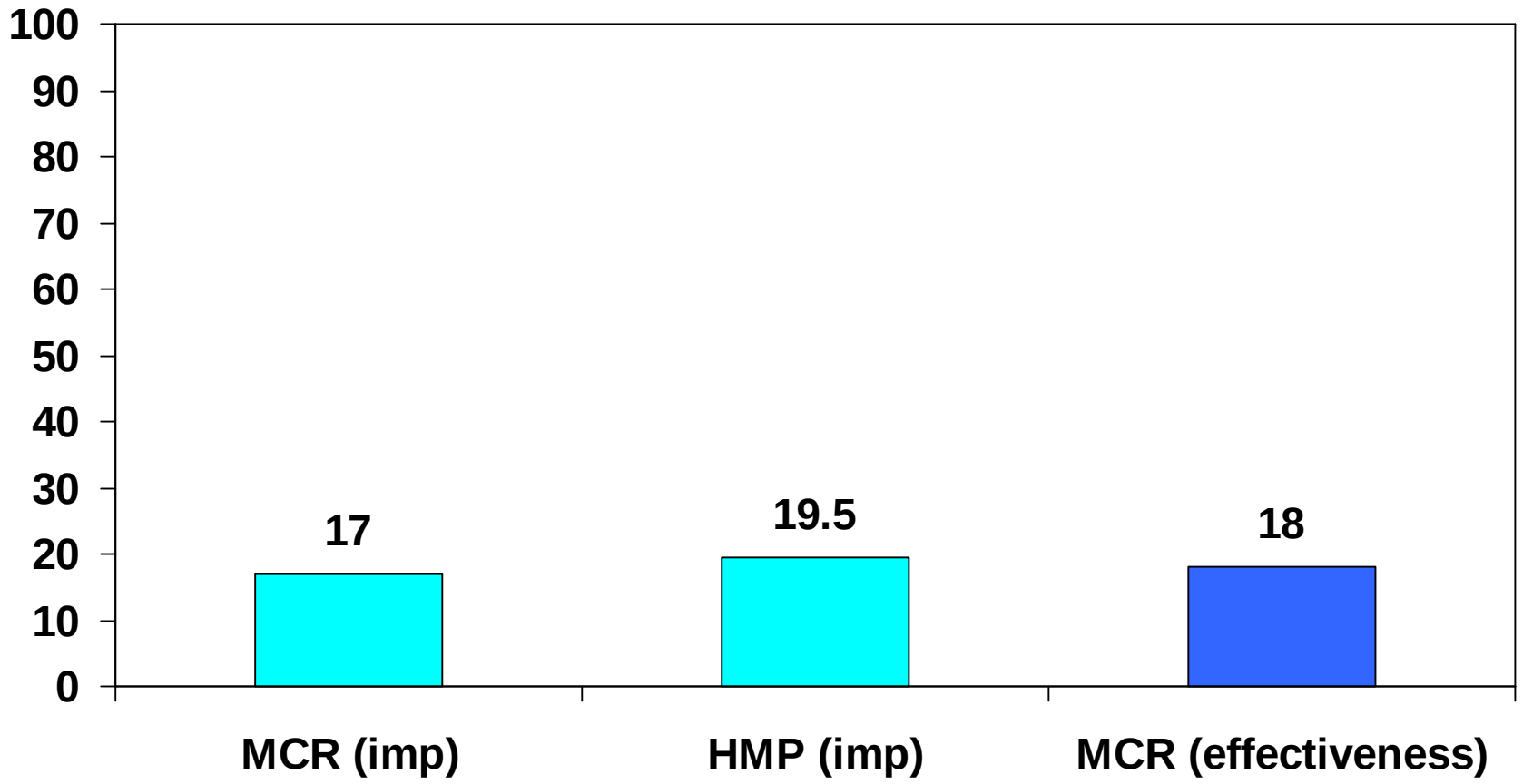
Culvert: Scour at Outlet

MCR vs. Hillslope Monitoring Program (HMP)

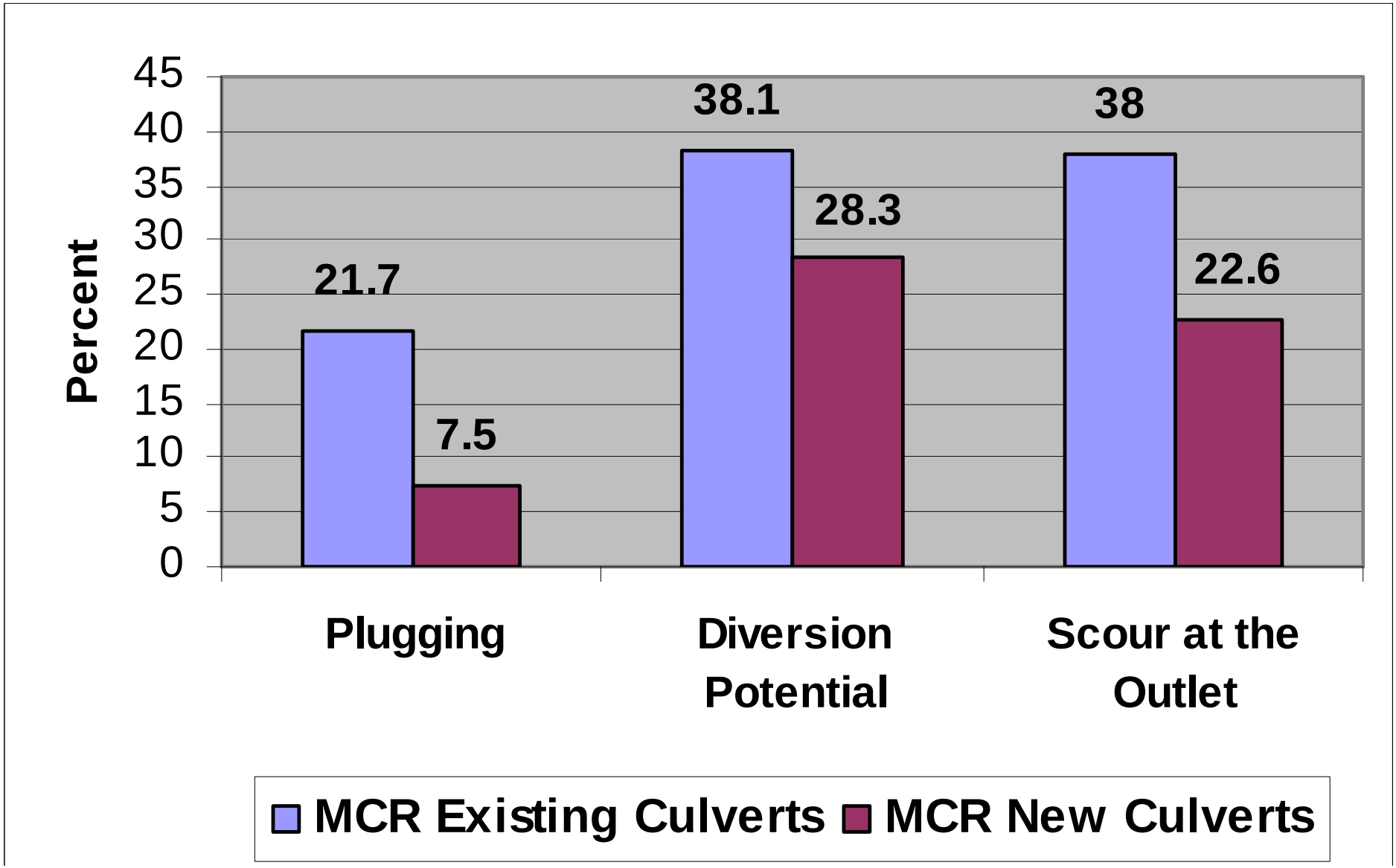


MCR: n = 181; HMP: n = 336

Percent of Crossings with One or More Departures (MCR), Major Departures (HMP), One or More Major Problems (MCR)



Comparison of MCR Existing and New Culverts for 3 Problem Types (Major + Minor Categories)



Modified Completion Report Monitoring Overall Findings

1. The rate of compliance with FPRs designed to protect water quality and aquatic habitat is generally high, and

2. FPRs are highly effective in preventing erosion, sedimentation and sediment transport to channels when properly implemented.

Modified Completion Report Monitoring Overall Recommendation

The Forest Practice Program should continue to emphasize education, licensing, inspection and enforcement to ensure proper implementation of the FPRs designed to protect water quality.

(continued)

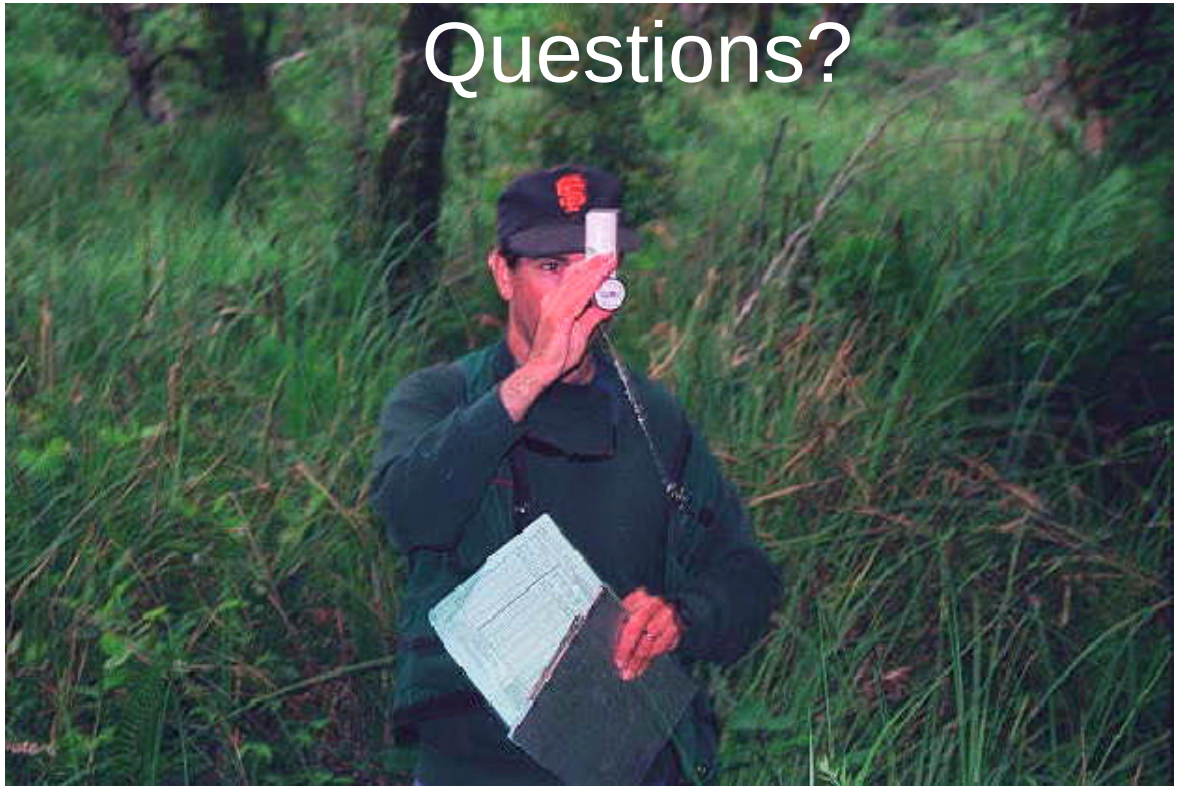
Modified Completion Report Monitoring Overall Recommendation

Since departures from the FPRs were found to be rare, the best inspection strategy is to have the inspectors focus on THPs and locations where their experience and previous plan review indicate that problems are most likely to occur. After a quick prioritization, inspectors should visually observe as much ground as possible to maximize detection of departures from FPRs, which are important but uncommon occurrences.

Modified Completion Report Monitoring

- Looking ahead:
- Phase II Modified Completion Report (MCR) Monitoring effort to complement the developing Interagency Mitigation Monitoring Program (IMMP).
- CDF's Audit Foresters will oversee MCR Monitoring in their Regions in Phase II.
- Some improvements to MCR methods will be based on experience to date.

Modified Completion Report Monitoring



Modified Completion Report Monitoring

http://
www.bof.fire.ca.gov/board/msg_supportedreports

1. The Final Report,
2. MCR Methods and Procedures, and
3. This Presentation

Available on-line at the
Monitoring Study Group's (MSG's)
webpage.